Science Dept.

The Electrical Industry's Weekly Magazine

March 23, 1959

Electrical World

Price 50 Cents

A McGraw-Hill Publication

Ohio Edison, State, Army Cooperate to Fit Plant on Narrow Site

...page 38

Reserve Margins—Less Than You Think

...p 81

Keeping the Lid on Fuel Costs . . . p 33

ST LOUIS PUBL LIBY
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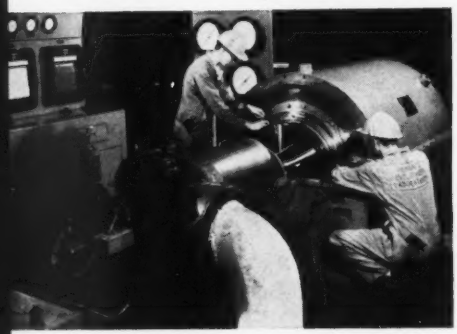
How General Electric is developing better steam turbine-generator service

Engineering seminars held at factory by men like J. E. Downs, Mgr.—Turbine Engineering, inform field service representatives of latest advances. Average professional experience of each local G-E service representative is 17 years.

Completely integrated service—from initial order of a turbine-generator throughout its operating life—is an *added value* available to purchasers of General Electric steam turbine-generator units. Experienced field representatives and local specialists, backed by a headquarters Product Service organization form an integrated service effort designed to help electric utilities achieve more economical generation of electricity.

Here are some ways that G-E service helps maintain the product superiority built into each unit:



Laboratory testing of full-size parts like new thrust bearing (above), other continuing studies, confirm component design improvements.

INSTALLATION SERVICE STUDY TEAM helps simplify field erection by continually studying methods for reducing installation time and cost. It also seeks easier inspection procedures by suggesting appropriate improvements in equipment design.

PERFORMANCE INTERPRETATION helps owners evaluate abnormal sectional pressures and efficiencies, loss of capacity, and other operating irregularities. General Electric initiates tests to prove new designs, and aids owners in conducting their own performance tests on duplicate machines.

ENGINEERING CONSULTATION is continuously available from factory components. Here electrical and mechanical engineers specialize in providing prompt supporting attention to problems that may arise during the life of your unit.

MATERIALS AND PROCESSES LABORATORY ASSISTANCE is offered for any unusual service requirement. Nearly 300 physicists, chemists, specialists and technicians are available for field studies, consultation, and advanced nondestructive testing.

MAINTENANCE TASK FORCE establishes procedures to speed repairs and minimize outages by: assuring efficient repair routines, carefully analyzing shop operations to eliminate uncertainties, and coordinating our action with owner's requirements.

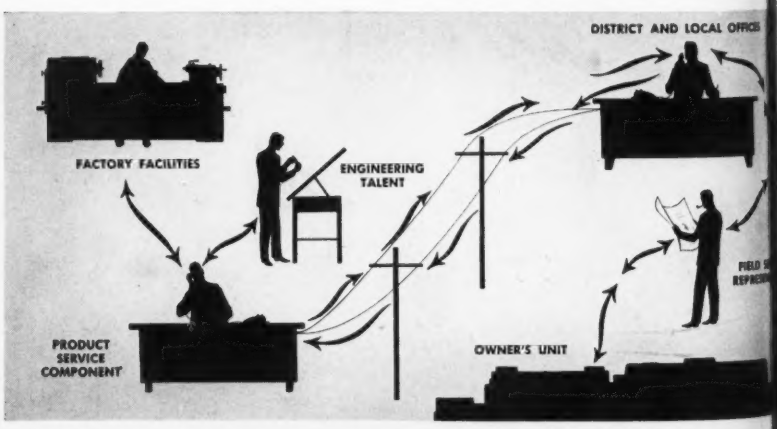
MATERIAL PROCUREMENT ADVANTAGES help reduce downtime. Large volume production, a backlog of currently approved materials such as composite forgings, tubing, and bar stock, and an efficient purchasing organization constitute power aids in meeting emergency requirements.

General Electric's integrated service program of KEEPING POWER MAKERS ON THE LINE provides a major *added value* that helps increase system efficiency and reliability, and reduce operating expenditures. For more information on this Program, contact your nearest G-E Apparatus Sales Office or write for Bulletin GED-3666 "Keeping Powermakers on the Line." General Electric Co., Section 301-392, Schenectady 5, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Engineering evaluation at plant site by G-E specialists improves installation time and costs.



Two-way flow of service information through Product Service component permits close liaison between factory personnel and field representatives on specific service problems.

Electrical World

Vol. 151, No. 12 MARCH 23, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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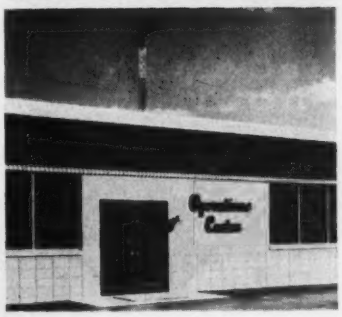

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CURRENT EVENTS

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Ad-Deduction Bill Draws Fire

California measure would prohibit tax deductions for advertising and direct mail expenses of utilities.....p 34

GENERATION

Joint Effort Puts Plant on Narrow Site

A Carnegie, Ohio Edison Co
J. H. Foote, Commonwealth Associates, Inc.

Ohio Edison shares benefits of joint planning for new Stratton Plant, dam and lock project, road improvement...p 38

METERING

Test Method Improves Metering Accuracy

Thomas Pendray, C. B. Woolley, Jr., Tennessee Valley Authority
L. M. Stanton, Electric Energy, Inc.

It provides data on voltage drops and phase shifts that can be used to correct errors in metering registration.....p 44

RELAY & PROTECTION

Microwave Ties System's Operational Centers

Tampa Electric's 5-station system provides reliable supervisory control over all substations.....p 42

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MUSCLES OF STEEL

The Series PM-2 Pole-Master is shown above on the popular Series 800-C Body. Derrick sizes for handling 40', 55', and 70' poles. Body sizes to fit your job needs.

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Guided auger digs straight, clean holes in practically any soil — even frozen ground and hardpan. Digs as deep as 9' 4". Can be used at various angles, too.

Let's Study Peaking Capacity Needs

Today we are hearing quite a bit about peaking capacity. This new discussion is brought about by the recognition of three factors. First, the industry has just about used up the old units that were always available for peaking purposes. They are either obsolete or occupy land which is too valuable. Second, peaks are of short duration in both winter and summer and a utility cannot afford to tie up $250 per kilowatt in generating and transmission systems for a full year to operate for such a short time. And third, new equipment can provide peaking capacity at the load at near $100 per kw and this is just what is needed for peaks due to space heating and other types of air conditioning.

As near as we can find out, there are very few problems that stand in the way of the use of small peaking units. The noise problem is one, and the fuel is another. And sites for pumped hydro is another. But we are now coming so close to a solution that every effort should be made to solve the few remaining problems in the way of economical peaking capacity.

Would a peaking capacity conference provide a helpful push?

Fischer Black

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In tube layout, too... design makes the difference with C. H. Wheeler condensers

You see here one of the many reasons why C. H. Wheeler Dual Bank Surface Condensers operate so efficiently in scores of public utilities and industrial plants throughout the country.

Triple Lane Tube Layout, with three separate pathways for steam travel, allows the steam to penetrate to the peripheries of all tubes.*

Design like this, typical of C. H. Wheeler engineering, steps up condenser efficiency. Other engineering advancements—such as patented Reverse Flow, which permits flushing away leaves, twigs, algae and other foreign matter—reduce maintenance requirements. "Zero" condensate temperature depression, pure condensate and deaeration to 0.03 cc. of oxygen per liter (special design provides for deaeration to 0.01 cc. of oxygen per liter) . . . are additional features you get with C. H. Wheeler Condensers.

**Location of the air-vapor take-off reduces the resistance to steam passage. This minimizes the depth of steam penetration through the tube bank of all C. H. Wheeler Condensers.*

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Whenever you see the name C. H. Wheeler on a product, you know it's a quality product

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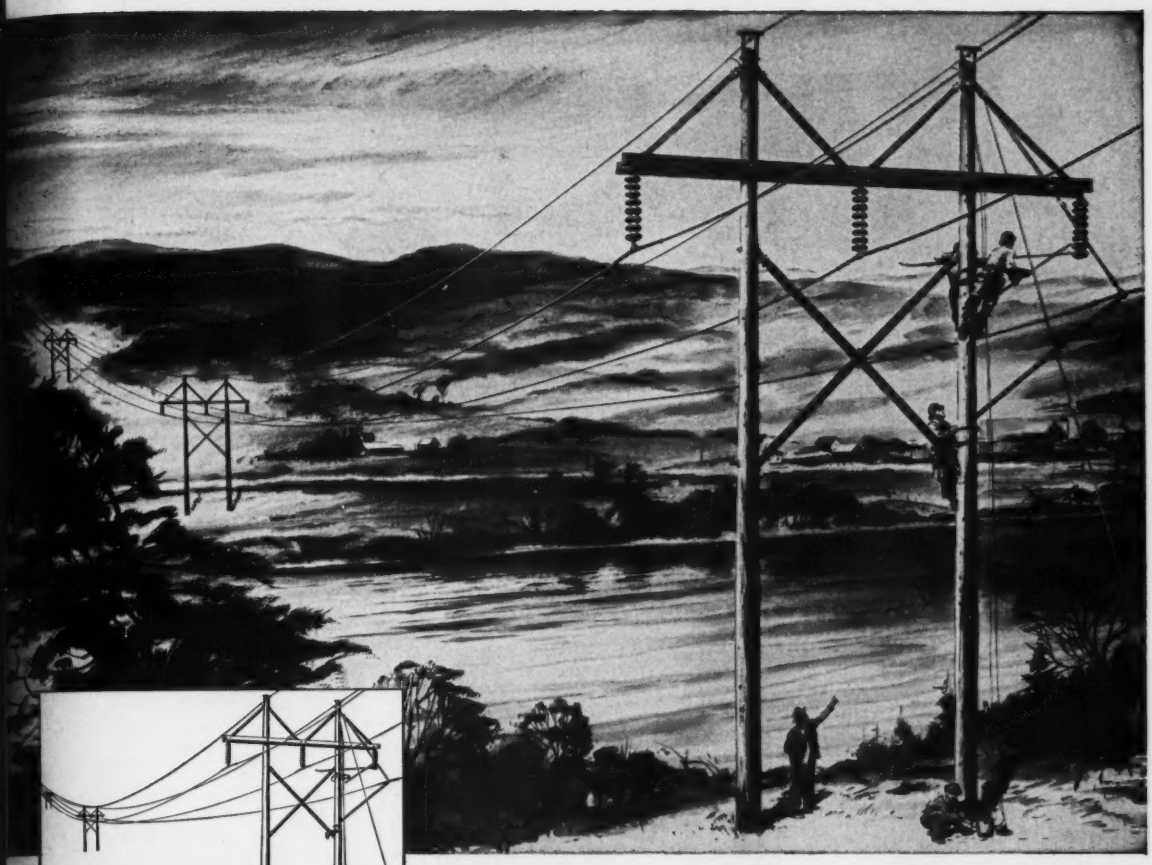

Graybar can supply everything that's shown above — except linemen and scenery — for line construction *and* maintenance. Poles, crossarms, hardware, tools—a partial list of items that are stocked at strategic Graybar locations throughout the country. All available for fast delivery to you. It pays to call Graybar . . . *first.*

From start to finish— arrange for continuing supplies and equipment—with Graybar

Engineers deep in the problems of new transmission *line construction* must be able to depend upon reliable, on-time deliveries to keep their schedules. And later, to meet the continuing task of *line maintenance*, the selection, dependable delivery and warehousing of supplies and equipment are vital.

Graybar backs up design and construction engineers to speed up these processes. Through more than 130 offices and warehouses, Graybar supplies prompt catalog information on everything electrical needed in line construction and maintenance.

To speed up the selection and delivery of anything and everything you need for line construction and maintenance call Graybar first. *Graybar Electric Company, 420 Lexington Avenue, New York 17, N. Y.*

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CALL **GraybaR** FIRST FOR

GRAYBAR ELECTRIC COMPANY, INC., 420 LEXINGTON AVENUE, NEW YORK 17, NEW YORK, IN OVER 130 PRINCIPAL CITIES

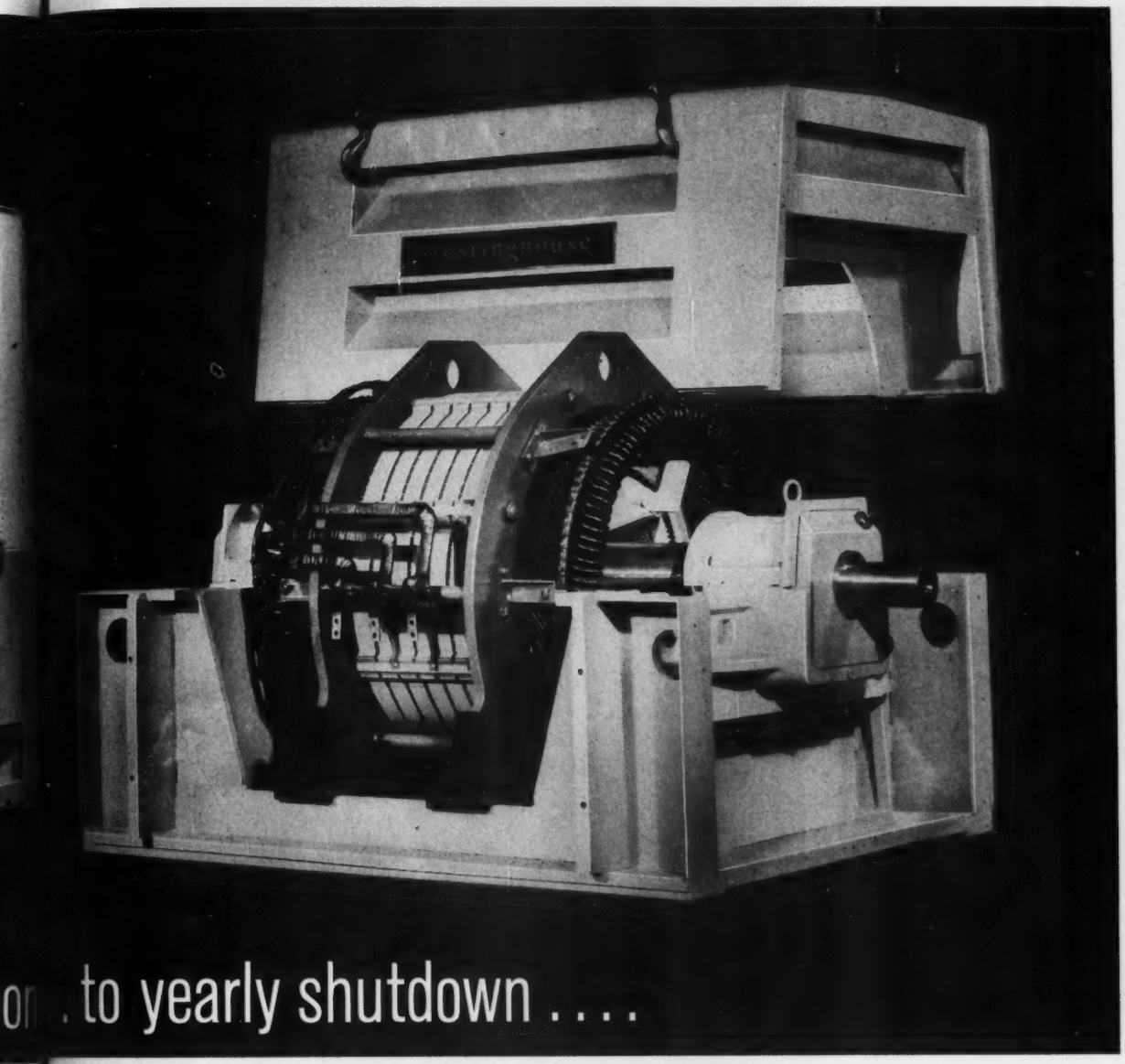
the F/A Motor saves you time and money!

Scheduled inspections and cleanings that result in longer life for your large motors are now easier, less expensive and—for the first time—accomplished with motor parts in *full view!*

The Westinghouse F/A Motor can be prepared for routine inspection, examined, and be back in operation in 10 minutes. For planned yearly inspections, complete disassembly and reassembly take only an hour.

Routine or Weekly Inspection. It takes just three minutes to prepare for this inspection. Merely removing the side panel completely exposes the leads, winding ends and rotor air ducts. A quick cleaning takes care of any contaminants. In four minutes the side panel is back on, and the F/A Motor is in operation.

Detailed Annual Inspection. Such a complete disassembly as is shown at the right, above, is rarely done, because in conventional motors it is virtually impossible. However, with the Westinghouse F/A Motor it *can* be done, and in just half an hour! No other housing design permits such



. . . to yearly shutdown . . . .

see-ability and accessibility. Here you can *completely* check windings and bracing, examine the ends of the rotor, check the condition of the *total* core and check all bolts for security. Necessary cleaning can be done in minutes, and with a thoroughness heretofore impossible. Then, in roughly 30 minutes, reassembly of side panels, top air shields, end covers and top enclosure puts the F/A Motor back "on the line."

For full information on the long service life, reliability and accessibility of the Westinghouse F/A Motor, call your Westinghouse representative or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-15003

CHECK THESE BONUS VALUES IN THE F/A MOTOR

- Full Accessibility
- Inherently Quiet—housing and stator separated
- Thermalastic® Insulation—recognized as the finest
- Time-Proven Components—longer, more efficient life
- Easy Connection—conduit boxes eliminated

YOU CAN BE **SURE**... IF IT'S

Westinghouse

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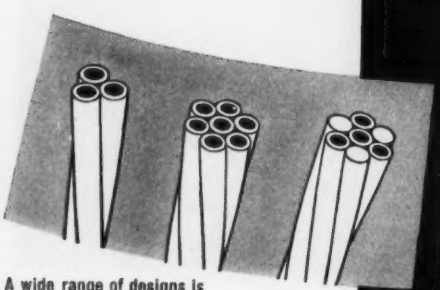

A wide range of designs is
both useful and economical

overhead ground wire

Exclusive features—

a **thick cladding** of aluminum
a controlled **atomic weld**

Give your transmission lines positive and permanent protection with the new light-weight, low-cost Alumoweld Overhead Ground Wire. It's the only aluminum-covered steel wire with a thick cladding of aluminum and the only one made by the controlled atomic-weld process.

Not only does Alumoweld have the strength of steel wire, but because of its 25% by area aluminum covering, it offers the added advantages of much higher conductivity and far greater service life. In fact, Alumoweld has corrosion resistance equal to solid aluminum wire, has one third the conductance, and eight times the strength. Just about optimum values for an Overhead Ground Wire!

In Alumoweld Overhead Ground Wire, you get three important benefits. (1) Its thick aluminum covering permanently protects the high-strength steel core against corrosion. (2) The electrical conductance is excellent for relaying and for discharging lightning and transient currents to ground. And, (3) Alumoweld's high strength permits stringing for ample mid-span clearance. Together, these add up to long-life protection and reduced service interruptions for your transmission lines.

For more information, write today for Engineering Bulletin E.D.3000.

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PRODUCT OF COPPERWELD STEEL COMPANY, WIRE AND CABLE DIVISION, GLASSPORT, PA.

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(GUARANTEED BY SYLVANIA)

A new plan to protect your lighting investment: Sylvania fluorescents must give you more light at lower cost than any other brand... or cost you nothing!

Now, Sylvania fluorescent lamps *have got to outperform all other brands* on the basis of uniformity of performance, uniformity of appearance, maintained brightness, and life. They *must* give you more light, at lower cost, than any other brand!

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Under a unique new policy, every large, regular user of Sylvania fluorescent lamps can have his lighting investment insured by Sylvania—at no cost to himself! If Sylvania's fluorescents do not live up to these claims, Sylvania refunds full purchase price.

How can we afford this kind of protection?

Answer: We know our product. We have studied it, worked with it for years to put it in a clear position of quality leadership. We can't lose.

And what better time to offer this new insurance than 1959—the year in which Sylvania engineers have swept *light-years* ahead of competition in fluorescent lamp efficiencies. For Sylvania fluorescents now give over 75 lumens per watt in the 75-watt, 8-foot lamp size . . . over 70 lumens per watt in the 40-watt, 4-foot size.

Ask your Sylvania representative or supplier to see a copy of the new Sylvania Light Insurance policy. And insist you get a policy with your next purchase. *If you prefer, write to us direct.*

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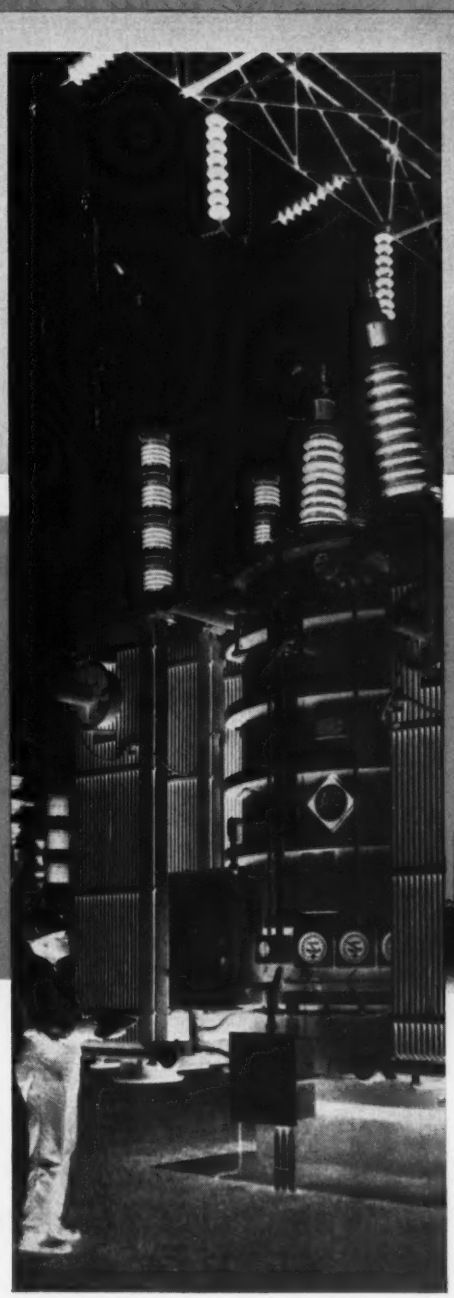
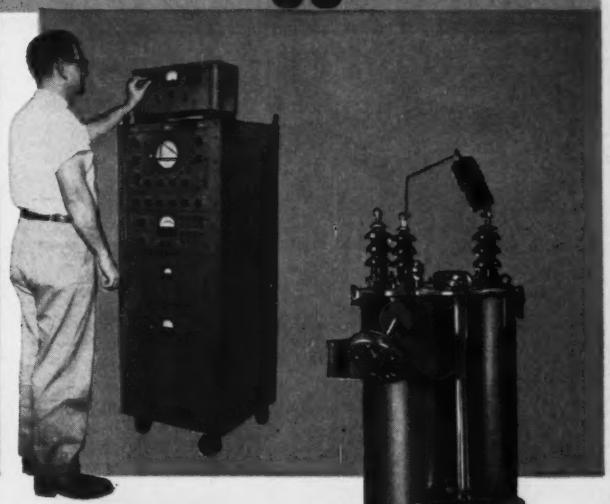
ALLIS-CHALMERS modern line for '59





Extras...Extras...

Read all about them

It's the extras that make the difference in the electrical equipment field today! There's much standardization today, but there's still room for the designer's genius. There's still room for features resulting from research or field experience.

While you're buying — update! And to update — look for the extras. They make the difference.

Some of the extras Allis-Chalmers offers are shown on the following pages. Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

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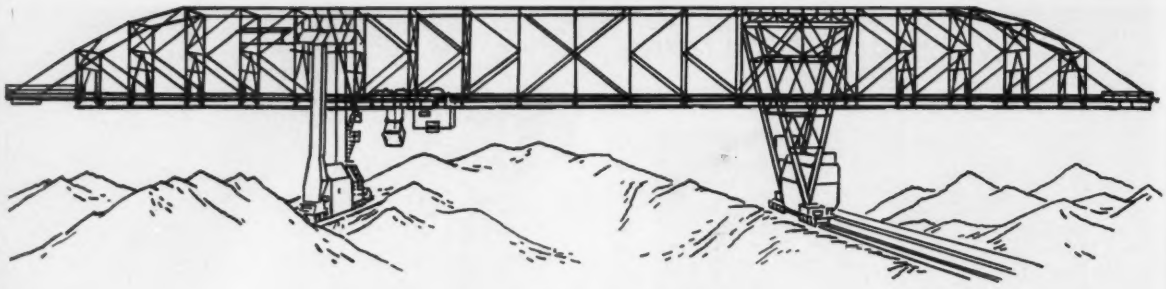
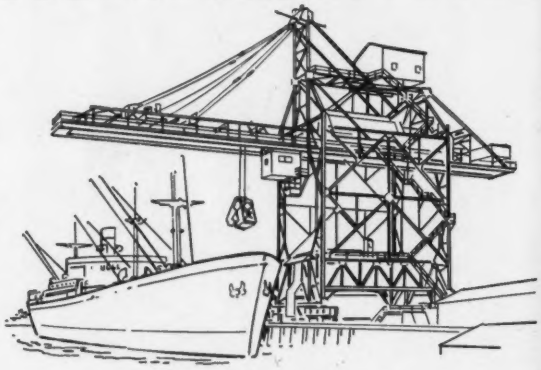
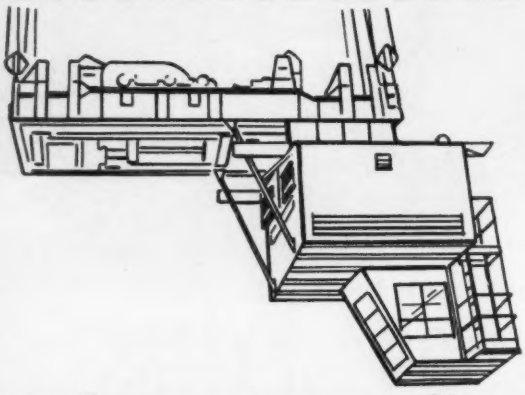


ore and coal bridges

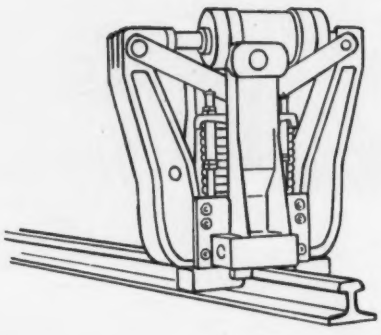
coal unloaders



ship unloaders



replacement man trolleys



Gale-Guard rail clamps

DRAVO

CORPORATION

FOR MORE INFORMATION, CONTACT: DRAVO CORPORATION • PITTSBURGH 25, PENNA. • SP. 1-1200

ALLIS-CHALMERS modern line for '59

Caliband control provides accurate settings quickly ... eliminates customer complaints

Now you can set or test voltage level and band width without changing customer voltage or interrupting regulated service. A twist of the *Caliband* control knob does it.

Caliband control demonstrator

Ask an A-C engineer to demonstrate *Caliband* control at your desk with an actual unit in a portable kit. Contact your nearby A-C office for a demonstration, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

Caliband is an Allis-Chalmers trademark.

A-5904

ALLIS-CHALMERS

Originators of 5/8% step regulators

Both initial and periodic tree trimming are cut to an absolute minimum with Rome's preassembled aerial cable.

Fast, efficient installations, even in densely wooded areas, are possible with Rome's preassembled aerial cable.

Trim your tree-trimming costs with Rome's preassembled aerial cable

Stringing power lines, especially through wooded areas, need not be a time-consuming, expensive installation. Not if you use Rome's preassembled aerial cable.

Because of the staunch characteristics of preassembled aerial cable, both initial and periodical tree-trimming time is cut way down. Initially, you need not clear as much of a right of way for preassembled aerial cable as is necessary in the case of open-wire construction. Periodic tree trimming can be put off for as long as five years, in some cases. This is compared to a normal two-year requirement for open-wire construction.

In residential areas, tree trimming can be a problem. Home owners, who have an inherent interest in the trimming of trees which grace their property, are very interested in the amount of trimming that is necessary. When using Rome's preassembled aerial cable, it is not necessary to disturb the trees as much as in the case of open-wire installations.

In addition to the tree-trimming advantages of Rome's preassembled aerial cable, there are many other "reliability" factors which you get by specifying this particular type of cable installation.

Improved Voltage Regulation

Aerial cable, because of its close geometric spacing as compared with open-wire circuits, has a lower reactance. Voltage drop is about half as great as typical crossarm construction. Similarly, for a given allowable voltage drop, power can be transmitted twice as far.

Storm Protection

You can reduce your storm maintenance costs due to the strength of preassembled aerial cable. Falling branches, or even trees, can be supported by the cable itself.

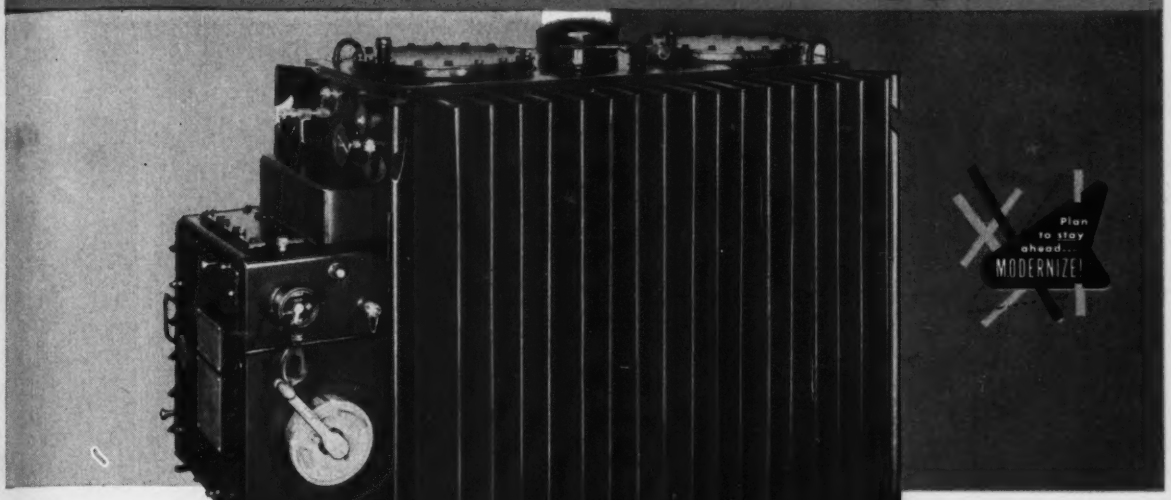
Other features of Rome's preassembled aerial cable include (a) practicality of mid-span tapping (because of reverse-lay construction); (b) improved appearance (elimination of pole crossarm hardware, in many cases); and (c) simplicity of installation.

Use Rome's preassembled aerial cable the next time you have to extend your power distribution lines. Your job will be easier and you'll save labor and maintenance expense. For more information on this product, call your nearest Rome Cable representative—or write to Department 770-B, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

ALLIS-CHALMERS modern line for '59



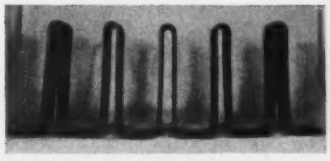
CURVACORE
DESIGN
shrinks network
transformers

reduced size and weight
cut installation costs

Smaller vault requirements per kva! That's the big economy advantage of the new Allis-Chalmers network transformer. Sizable savings in excavation and construction costs take much of the sting out of high labor rates. With a smaller, lighter transformer to handle, work crew efficiency is improved in installation. And, of course, increased kva may be installed in existing vaults where system growth requires it.

Utilities gain, too, in improved performance. Use of quality controlled *Curvacore* construction and advanced design techniques assure greater efficiency... lower exciting current and lower losses.

For detailed information on this compact transformer, call your local Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



Corrugated tank slashes maintenance

All cooling surfaces are accessible for repainting by brush, spray or flow. Simplified preventive maintenance reduces chance of corrosion damage. Tank retains its original high strength.

Curvacore is an Allis-Chalmers trademark.

A-5939-E

ALLIS-CHALMERS

The Port of Portland's extreme reliability requirements are met by S&C's Fused Interrupter Metalclad Switchgear with S&C Automatic Transfer Panel and Moto-Draulic Operators

Nation's newest jet-age terminal gets modern S&C Metalclad Switchgear

8-Bay assembly of S&C Metalclad Switchgear contoured to fit location at Portland International Airport.
Consultant on high-voltage electrical equipment: George A. Drewett, area engineer for Pacific Power & Light Co.

Extreme reliability of electrical services is a major requirement of the modern jet-age airport, because of the great number of vital radar and lighting needs.

Pacific Power & Light's staff studies showed that this high degree of reliability suggested the use of fused interrupters metal-enclosed, with an integral automatic transfer panel controlling operators for preferred-to-emergency switching.

Result: Modern S&C Metalclad Switchgear was specified.

The power circuits of this modern new airport are run in conduits or protected cable trays, and so are free from transient faults. The proper protection against the only type of fault which is likely to occur—a permanent fault—is the Power Fuse as employed in S&C Switchgear.

To maintain continuity of service, the installation uses S&C Load Interrupters actuated by a Moto-Draulic Operator which is controlled in turn by an S&C Automatic Transfer Panel. This modern equipment meets new, modern standards of reliability, and at the same time saves as much as 50% in capital outlay for switchgear.

For information, write S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

Specialists in High-Voltage Circuit Interruption for Utilities Since 1910

S&C

METALCLAD SWITCHGE

The Electrical Week

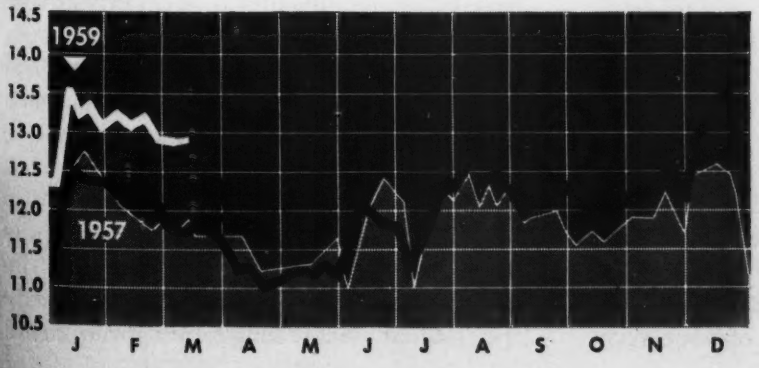
FUTURE NEWS ▶ **Watch for further modifications of Sen Neuberger's bill** for a Columbia River Development Corp. The Oregon solon has delayed introducing the measure until after Easter to give other Pacific NW senators a chance to discuss it with their constituents.

LATE NEWS ▶ **Indiana & Michigan is considering the purchase of municipal plant** in Portland, Ind . . . Northern Indiana PS buys Pierceton, Ind., municipal electric system for $165,000 . . . Arizona PSC okays purchase of Verde Electric Co-op by Arizona PS . . . Akron, Ohio, City Council votes 9-3 for Ohio Edison to boost rates by an estimated $700,000 a year.

Washington Wire . . . FPC will hold hearings April 28 on Grand River Dam Authority application to increase hydro capacity at Markham Ferry, Okla., to 100,000 kw . . . SEC and Commerce Dept report that electric utility industry will spend 4% less on new plant in '59 than it did in '58 . . . AEC will hold public hearings on health and safety aspects of power reactors proposed for "partnership" development by rural co-ops or public power bodies . . . General Accounting Office takes a swing at Shippingport A-station arrangements in report to Congress. Items: (1) Under certain conditions, a considerable amount of government property would become property of Duquesne Light Co without any reimbursement; (2) Higher than expected costs are at least partially attributable to using a prime contractor which lacked experience in administering a major construction project; and (3) timely and effective audits were not made.

Distribution transformer prices are being revised, effective today. GE reduces prices on most higher voltage single-phase units, but hikes them on some larger kva pole-type units. Westinghouse will generally reduce prices on frequently ordered standard sizes.

WEEKLY POWER OUTPUT—UP 9.6% (Week ending Mar. 14), Kwhr 12,996,000,000



Per Cent Change From Previous Year

	Feb. 28	Mar. 7	Mar. 14
Total U. S.	+ 9.9	+ 9.8	+ 9.6
New Eng.	+ 8.9	+10.0	+11.5
Mid. Atlantic	+ 7.3	+ 7.8	+ 9.2
Cent. Ind.	+12.9	+12.6	+13.5
West Cent.	+10.5	+ 8.5	+ 8.9
Southeast	+ 7.7	+ 8.5	+ 5.5
South Cent.	+12.2	+11.8	+12.5
Rocky Mount.	+ 9.9	+ 8.6	+ 6.1
Pacific			
NW	+12.5	+ 7.4	+ 6.0
SW	+ 7.7	+ 9.6	+10.8

Seasonally Adjusted Index 251.6

Week Ago 250.4 Year Ago 228.9

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **Utilities are coming out ahead on recent fuel developments.** Some eastern companies are keeping the lid on coal costs by negotiating for lower prices and haulage charges. Ike's mandatory oil import program to have slight effect on price of residual oil **(p 32)** . . . California solons get a bill to disallow all gas and electric utility advertising **(p 33)** . . . TVA bond-financing bill approved 19-14 by House Public Works Committee. Area-limitation amendments proposed **(p 36)** . . . New TVA 161-kv line to have 7-mile, 460-kv section **(p 35)** . . . Denver firm to introduce kit for converting Chevrolets, Fords and Plymouths to all-electric locomotion **(p 34).**

ENGINEERING ▶ **Ohio Edison, the State of Ohio, and the Army cooperate** to solve a difficult space problem in locating the company's new Stratton Plant along the Ohio River front. Commonwealth Associates' J. H. Foote outlines this week's cover story **(p 38)** . . . TVA engineers T. Pendray and C. B. Woolley, and L. M. Stanton of Electric Energy, Inc, are using a new test method to get data for correcting meter registration **(p 44)** . . . Tampa Electric uses a five-station microwave system to tie together its operational centers, business offices and mobile fleet **(p 42)** . . . Penta-treated poles remain in good condition after 17 years of service; have many good years left **(p 41).**

Politics and Public Power

CONFUSION AT NRECA?

These must be confusing days at the National Rural Electric Cooperative Assn, judging from what its officers have been saying in Washington.

Recently, William Wise, NRECA attorney, told a Senate Agriculture subcommittee that rural electric co-ops must be allowed to serve some good industrial and commercial loads or they won't be able to repay their loans to REA. He was testifying in favor of Sen George Aiken's (R-Vt.) resolution to clarify the REA's right to make loans to serve any unserved persons in rural areas, regardless of their proximity to existing power lines. Quote Wise: "Unless these cooperatives can serve some of the cream that moves into these areas, the government is not going to get its money back." He added that this situation "is not true of your very rich co-ops, but in hundreds of them throughout the country it is true." He claims that the situation has worsened because private utilities have "moved in" on the co-ops.

NRECA General Manager Clyde T. Ellis did not testify on this subject, apparently deferring to Wise. Perhaps it is well that he didn't, for if he had repeated some of the things he said to his members and managers only a month before, the subcommittee might have had some difficulty resolving them with Wise's testimony.

In his speech "Forward Together," at the NRECA annual convention in February, Ellis called for a system reserves pool to "stop waste, and provide liquidity." Such a pool, according to Ellis, "would be able to invest a reasonable portion of its funds quite soundly in the highest grade 'blue chip' industrial bonds and most of the balance in the highest yield long-term governments.

MANAGEMENT ▶ **Reserve margins are smaller than they look.** The conventional yardstick for measuring them—the December peak—has been warped by the rise of summer peaks. For a more meaningful margin, computed by region as a percent of its peak for the calendar year, turn to **page 81** . . . The steel industry is in for a slow third quarter, strike or no strike, but it won't drag down the rest of the economy **(p 83).**

MANUFACTURERS ▶ **Daystrom is building automatic power plant control system** for Louisiana P&L's Little Gypsy station. The completely automatic system will start up, operate, and shut down the 225-Mw, single-unit plant without human intervention . . . Minneapolis-Honeywell and Philadelphia Electric collaborate on power-plant computer system **(p 55).**

NEW EQUIPMENT ▶ **A line of "super-compact" substations** are designed primarily for long, lightly loaded rural or suburban lines . . . Cable repair kit is completely hand operated . . . Guy protector is quickly installed, using a single bolt and spring clip . . . Photoelectric control provides high resistance to arc-over damage **(p 66).**

SELLING ▶ **Texas Electric Service uses Reddy Kilowatt to electrify oil wells** . . . Russians claim a new rubber-carbon electric heating element **(p 87).**

None of the reserves principal would be invested in equity common stocks but, for those participants which choose to let their interest accumulate, that interest increment could be invested in high grade commons as a hedge against inflation. The pool would have a constant inflow from maturing investments and from new investments and, therefor, would have to keep on hand only a relatively small amount of short-term low-yield governments."

Now, regardless of the merits of the idea of allowing NRECA to manage or control the co-ops financial reserves—and that's what the plan, as Ellis proposed it, sounds like—this kind of proposal seems a highly unlikely one before a group whose members are supposedly in financial trouble. The size of this reserves pool has been estimated at as high as a half a billion dollars—no negligible amount of money, even in these times.

But there is additional evidence that the co-ops are not so bad off as NRECA would have Congress believe they are, and this evidence is supplied by the government itself. Here are some of the highlights of an analysis of the Rural Electrification Administration reports for 1957, the latest year for which they are available:

- Taxes as a percent of operating revenue approximate 2.76% compared with 23.1% for private industry.
- Long-term debt as a percent of net plant continued its four-year decline to 101.9%.
- Interest on long-term debt was 1.87%, considerably below the cost of money to the government.

But the Democratically-controlled Congress is likely to look at these economic facts through politically-colored glasses, which means they will see only what they wish to see, confusion notwithstanding.

Logic of system planning leading to the optimum plan for expanding generation and transmission is under comprehensive study by a 23-man operations research team representing Public Service Electric & Gas and Westinghouse Electric. Scope of the study requires investigations in mathematics, economics, and utility design, operation and planning. **Program for Planning, J. K. Dillard, and H. K. Sels, Electric Light & Power, February 15, 1959.**

Valve buyers are aided by the current soft market in standard items, but late deliveries may be expected for valves in the 900 to 1,500-psi range. One firm is ordering all valves for a three-unit generating station, even though the station is being built one unit at a time. **The Iron Age, March 5, 1959.**

We must "stop buying socialism on the installment plan" if we are to keep the free American from vanishing. These things should be done now: Inform ourselves and others, especially the younger generation; register to vote and take an active part in self-government; make our views known to elected representatives; and don't use government as a crutch ourselves. **Elmer Lindseth, Cleveland Electric Illuminating Co, before The Rotary Club of Cleveland.**

TECHNICAL NOTES

Thermoelectric properties may be the clue to the amount and nature of impurities in unknown metals. A recent theory of the mechanism of a thermocouple suggests that the nearly infinitesimal movements of atoms within the wire help accelerate the electron flow. **Dr. Frank Blatt and Richard Kropschot, Michigan State University.**

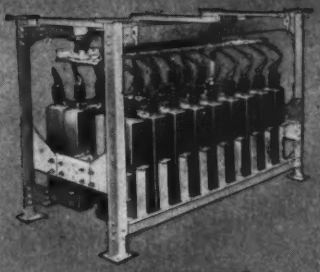
Cooling needs of a house are determined on a computer which weighs over 50 factors that influence indoor temperature. First uses of the computer include a study of house construction to find the most economical design for air conditioning. **Westinghouse Electric Corp, Pittsburgh.**

A lubricant may show an elastic response to a stress if it is stressed rapidly enough. This condition, known as viscoelasticity, could affect the design of high-speed bearings and gears. **Viscoelasticity in Lubrication, G. J. O'Donnell, Mechanical Engineering, February, 1959.**

Loss of life not over 3% for each contingency on the hottest summer day results from advances in protector and fuse design which permit contingency loading of network transformers at 150% of nameplate. **L. Falkenstein, A. Newman and O. Turner, Transmission and Distribution, February, 1959.**

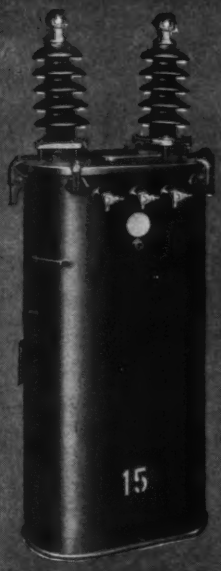
the Most Complete Line of Equipment for 20/34.5 kv Distribution

L-M'S 27 KV TYPE SS distribution valve type arrester provides low-cost protection for 150 kv BIL apparatus.

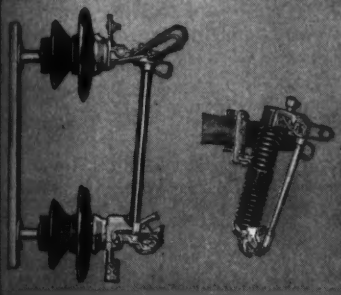


CAPACITOR EQUIPMENTS, blocks and banks to any size.

KYLE TYPE E RECLOSER, 23 kv, 150 kv BIL, in standard ratings, for single-phase extensions of the 20/34.5 system where the potential across the recloser will at no time exceed the maximum design voltage of 25.8 kv.



20 KV ROUND-WOUND® TRANSFORMER, specifically designed for this service, with 150 kv BIL, high overload capacity, low exciting current, and low losses.



TYPE HXO POWER FUSE (left) and Type HDO fuse cutout. The 27 kv, 100 ampere HDO has a rated interrupting capacity of 4000 amperes. The 38 kv, 200 ampere HXO has a rated interrupting capacity of 5000 amperes.

How 34.5 kv Distribution Cuts Costs... Here's Data on Methods, Materials

- Idaho Power Company pioneers 20/34.5 kv distribution, with ten years' experience.
- L-M pioneers, with research and development on apparatus, construction materials, and application for this economical distribution voltage.

by J. R. McDONALD, Field Engineer
Line Material Industries

Complete elimination of subtransmission, with fewer substations, higher feeder loading, and reduction of regulating equipment, resulting in lower cost per kva of installed capacity, appear to be among the major advantages afforded by 20/34.5 kv distribution, according to Idaho Power Company.

This progressive company now operates 275 pole line miles at this higher distribution voltage, and is expanding the system to serve additional farm customers. Idaho Power has found economical methods for conversion, and its experience is being generously offered to the industry. At the same time others, such as H. L. Hess of the Public Service Company of Indiana, Inc., have published the results of their studies.

LINE MATERIAL® Industries
McGRAW-EDISON COMPANY
Distribution Equipment
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L-M Provides Information, Apparatus

L-M has collected some of this data, and is offering a compilation, along with information on the apparatus and equipment L-M engineers have developed in working with Idaho Power Company and others.

Mail This Coupon For More Information

Ask your L-M Field Engineer for copies of papers L-M makes available on 20/34.5 kv distribution, or mail the coupon—and we will send them promptly—no obligation.

LINE MATERIAL Industries, Milwaukee 1, Wisconsin EW-3239

Please send, free, copies of the following papers:

- ☐ 20/34.5 kv—An Economic Solution, by Don E. Haasch, Special Studies Engineer, Idaho Power Company
- ☐ 34.5 kv—A Possible Future Necessity, by H. L. Hess, Distribution Engineer, Public Service Company of Indiana, Inc.
- ☐ 20/34.5 kv Multi-grounded Wye Distribution System, by George W. Cooper, Line Material Industries
- ☐ Relative Merits of 20/34.5 kv Distribution by D. L. Andrews, Distribution Studies Engineer, Idaho Power Company
- ☐ The Long-Bus Substation, by D. L. Andrews, Distribution Studies Engineer, Idaho Power Company
- ☐ SEND ALL FIVE PAPERS PLEASE, IN FOLDER IMPRINTED WITH MY NAME

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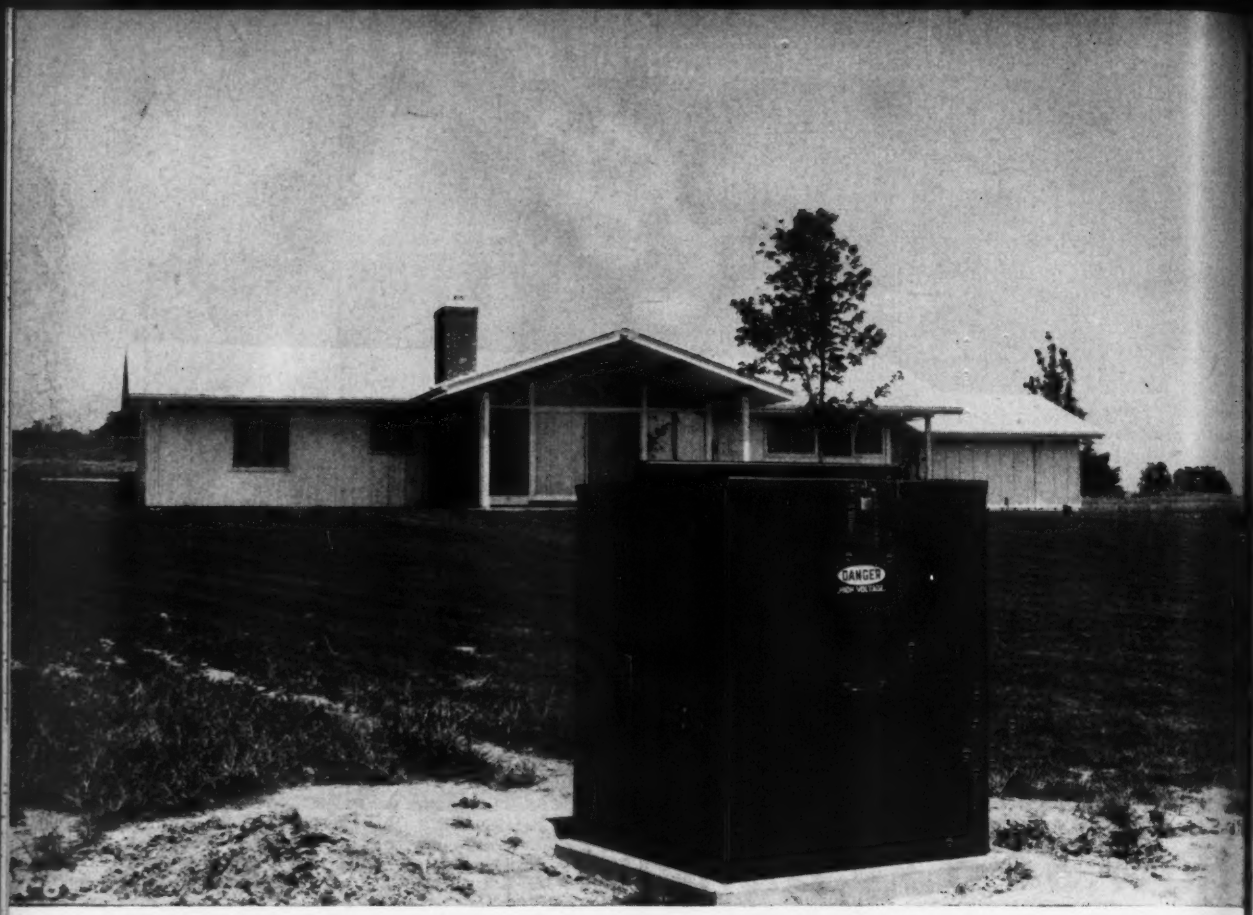
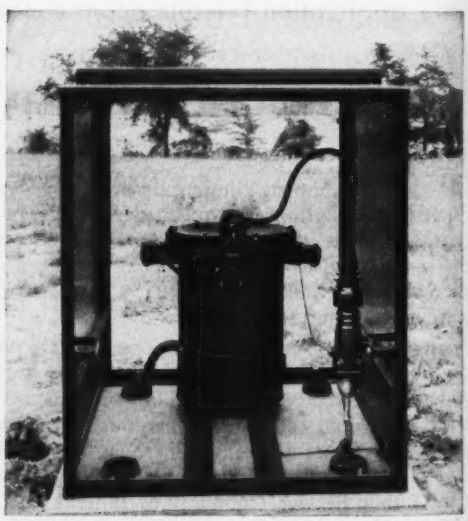
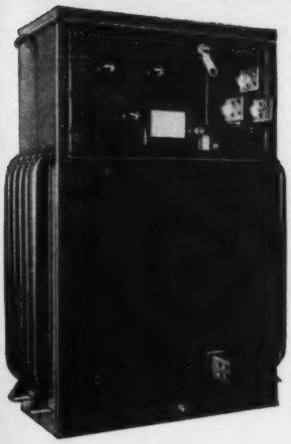


L-M TRANSFORMER ENCLOSURE, installed, on a concrete pad, prior to planting with shrubbery, which can hide the unit completely. This enclosure contains a standard pole-type 15 kva Round-Wound® transformer, cutouts, and accessory equipment. Covered opening at top provides chimney action ventilation. Enclosure is 12-gauge steel, painted with zinc-rich coating and weatherproof finish coat. It comes knocked down, is bolted together on the job site. Unit shown is a 5 kv enclosure which takes a maximum transformer size of 50 kva.

TRANSFORMER ENCLOSURE, which has just been assembled on the job site, being mounted on concrete pad, which is provided with openings for leads from the direct burial primary cable and secondary. The enclosure is bolted down to the pad with tamper-proof bolts inside the housing. Both front and back panels are removable, and are provided with hasps and staples for padlocks.



L-M ENCLOSURE with pothead from primary cable, fuse cutout, and pole-type transformer in position. Arrangements can be made for mounting cutouts, arresters, reclosers, sectionalizers, switches, secondary service meters. This type of construction lends itself to low-cost underground construction and meets the requirements of subdivisions and other locations where pole lines are prohibited.



Left, L-M PAD-MOUNTED TRANSFORMER; center, transformer with enclosure bolted on the front. Right, enclosure closed with place for padlock below door handle. Note, at left, that fins between tubes and tanks prevent use of tubes to tie fence or aerial guys. Center view shows separate door for the high voltage compartment on the left side and barrier plate between high and low-voltage compartments. Mounting pads are provided inside the compartment for accessory and protective equipment, and for secondary service meters if desired. Complete welded construction; no loose panels; weatherproof finish. Each compartment takes three sizes of transformers so transformer size may be increased without changing secondary wiring.

These transformers are available in single-phase from 25 to 167 kva, 12470 GrY/7200 volts—240/120 volts; and in three-phase L-M Uni-Wound design from 75 to 500 kva, 12,000 volts delta.

L-M Announces New Surface-Mounted Transformer Units For Underground

Line Material, a leader in research and development of equipment for underground distribution, produces a new pad-mounted transformer and an enclosure, both for above-ground installation.

Utility companies are facing growing demands for underground construction. Conventional type underground is costly. L-M's new pad-mounted transformer, and a transformer enclosure for a pole-type transformer, bridge the gap between overhead and full subway construction. These units may be used with full or partial conduit installations or with direct-burial cable.

Appearance With Economy

When planted with shrubbery around them, both the transformer and the enclosure make a great contribution toward solving the appearance problem, and still providing required safety, convenience, and accessibility.

L-M engineers are constantly studying underground distribution, are working with utilities to help solve their problems. The items shown here are just two of many L-M developments. Many others are in production or on the boards. If you have ideas or problems, let's talk them over—perhaps we have something that's exactly what you need.

Pad-Mounted Transformers

The transformer is a full-output L-M Round Wound transformer with a locked, tamperproof cabinet fastened to the transformer tank. This cabinet covers live parts and provides space for protective and accessory equipment and service meters. A separate inner door locks the high-voltage connections. This transformer is available in several sizes, in single and 3-phase units. (See photo caption above.)

Transformer Enclosure

The housing is heavy sheet steel to be mounted on a pad, and designed to hold a conventional pole-type transformer and protective equipment. Arrangements can be made for mounting meters, and for telephone service equipment. The enclosure comes knocked down, is bolted together at the job site—which makes it very convenient to handle. Shielded opening at top provides chimney-action ventilation. Several of these enclosures may be grouped, to hold several transformers or additional accessory equipment.

Get Complete Data

For literature on pad-mounted transformer and transformer enclosures, contact your L-M Field Engineer; or write Line Material Industries, Milwaukee 1, Wisconsin.

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LINE MATERIAL Industries

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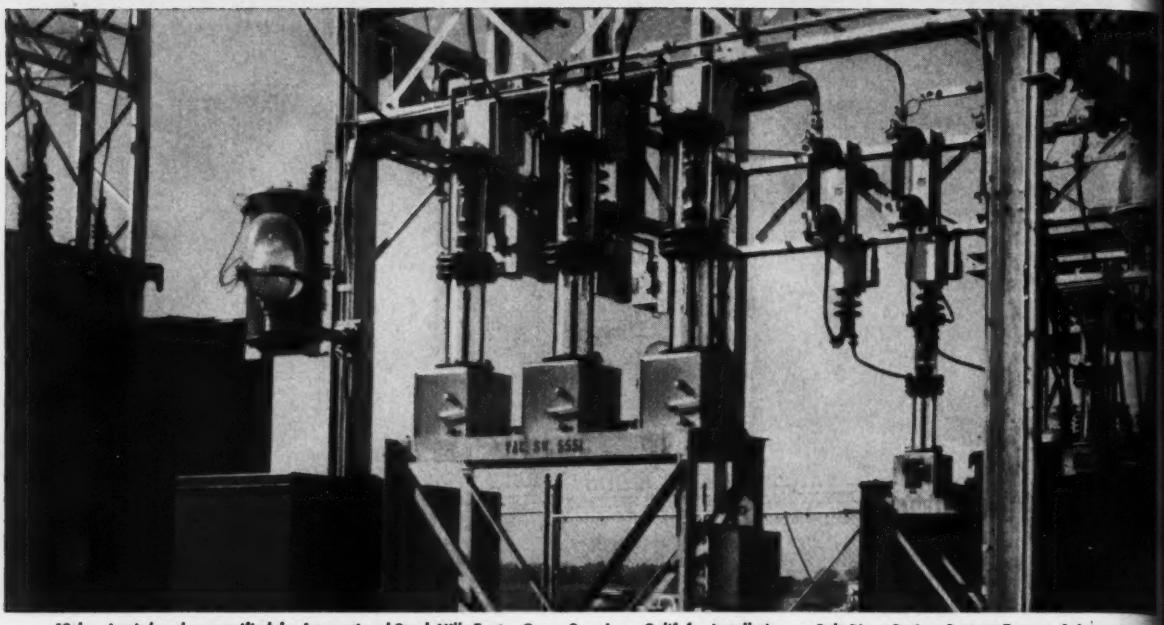
Transformers

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT



12 kv circuit breaker specified by International Steel Mills Equip. Corp., San Jose, Calif. for installation on Salt River Project System, Tempe, Arizona

Sensational New *Vacuum Power Switches* offer Long Life ... *Maintenance Free!*

Exceptionally long life and elimination of maintenance were major considerations affecting the decision of International Steel Mill engineers to select Jennings vacuum power switches to control and protect their new 5000 and 2500 kva arc furnace transformers.

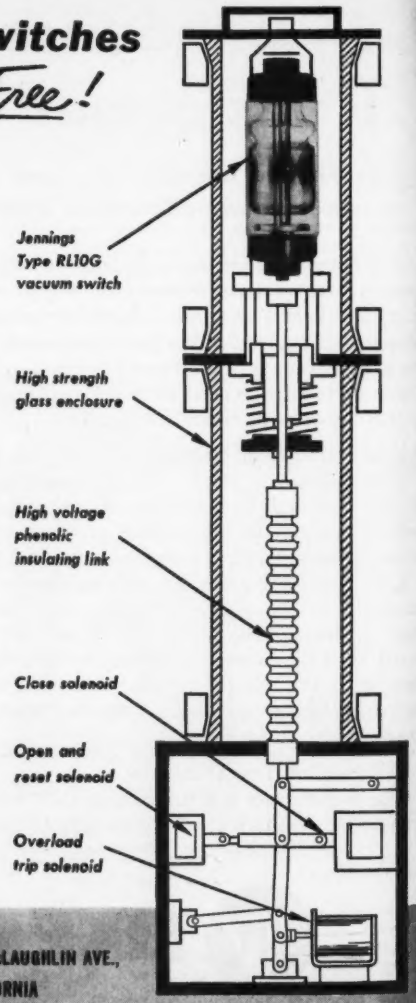
Jennings vacuum switches are able to provide long life because the combination of tungsten contacts plus a vacuum dielectric minimizes arc erosion which eliminates the problem of contact maintenance common to other high voltage switching devices. International Steel Mill engineers report contact life of 20,000 operations in a similar application.

The complete circuit breaker as supplied to International Steel Mills has been shown in the line diagram at the right to illustrate another inherent advantage of high vacuum switches. Their extremely high dielectric strength allows switchgear design with minute contact openings of only 5/32 inch permitting small, light-weight actuating mechanisms. Depending on requirements, fault current interruption can be accomplished within 1/2 to 2 cycles after the fault is initiated.

Vacuum power switches have proven particularly successful in applications involving capacitor switching, fault current interruption, transmission line dropping and load break switching.

Our distribution of vacuum switches is through switchgear manufacturers who design and build complete switchgear equipment, utilizing Jennings vacuum switches.

More detailed information on our ten sizes of power switches is available on request



Jennings RADIO MANUFACTURING CORPORATION • 970 McLAUGHLIN AVE., P. O. BOX 1278 • SAN JOSE 8, CALIFORNIA

T-lug accommodates one size larger tap than line wire—widely separated from line to minimize galvanic corrosion.

Only 3-11/16 inches high. Streamlined and compact. Adaptable for use on small stirrups.

Screw chamber lubricated for full thread protection.

Internal jaw stop engages in body channel to limit travel, prevents jaw and body from separating.

NEW KEARNEY

3532-series protected-thread HOT LINE CLAMP

assures positive current transfer...

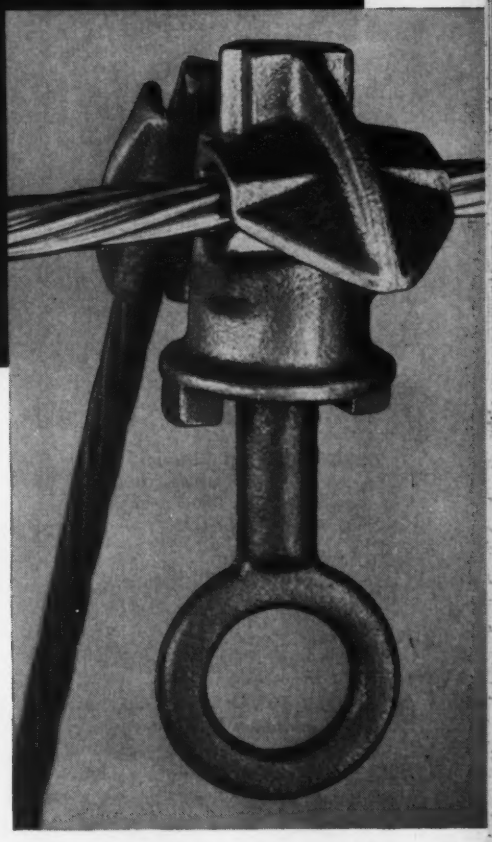
Accommodates all-conductor combinations—copper-to-copper, copper-to-aluminum, aluminum-to-copper, and aluminum-to-aluminum.

Kearney's newly-designed 3532-series hot line clamps are available as follows:

Line Side Range

ALL BRONZE BODIES.....#6 Sol. Cu.—#2 Str. Cu.
ALL ALUMINUM BODIES.....#6 Sol. Al. —#2 ACSR
FULLY PLATED BRONZE BODIES..#6 Sol. —#2 ACSR

Tap Side Range.....#6 Sol. —1/0 ACSR



Wide, deep-seated contacts match line conductor contours, long-line contact surface assures positive current transfer between each outside strand and clamp.

JAMES R. KEARNEY CORPORATION • 4224-42 Clayton Avenue • St. Louis 10, Mo.

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FOR BETTER CONSTRUCTION—SAFER MAINTENANCE

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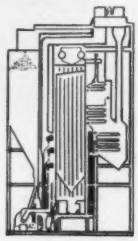
Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. • GUELPH, ONT., CAN.

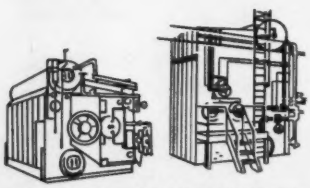
Power Plant Products

HEAT ENGINEERED BY FW

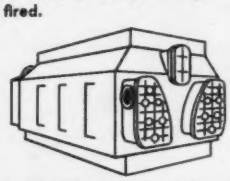
LARGE STEAM GENERATORS

Designed to meet all requirements for Central Station or Industrial power plants, in single- or twin-furnace designs, with or without reheat or dual circulation.



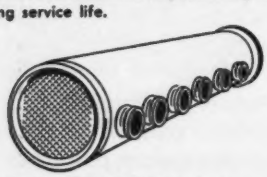


PACKAGED and FIELD-ERECTED BOILERS—Compact, economical, standardized units in capacities from 10,000 to 450,000 lb/hr, oil, gas or pulverized coal fired.

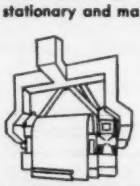


CONDENSERS and HEATERS—Condensers of single or two-pass, double or counter-flow designs. All-welded high and low pressure feed-water heaters.

COOLING TOWERS—Induced draft counter flow towers of all-redwood construction for maximum dependability and long service life.



NUCLEAR COMPONENTS—Heat exchangers, steam generators, pressurizers, reactor vessels, separately-fired superheaters for stationary and marine power plants.



PULVERIZED FUEL SYSTEMS—Completely engineered systems utilizing FW ball mill or MB planetary roll and table pulverizers.

HEAT ENGINEERING b

WORLD'S FIRST 2

NATURAL CIRCULATION S

321,500 kw Unit No. 3 at Detroit Edison's River Rouge Power Plant is served by a Foster Wheeler Reheat Steam Generator —one of the most efficient ever built

One of the largest steam generators ever built, this unit was heat engineered by Foster Wheeler to meet the most exacting plant requirements. It supplies Detroit Edison's River Rouge Unit #3 with *two million* pounds of steam per hour at 2450 psi and 1050 F at the superheater outlet. The steam is reheated to 1000 F after it has passed through the initial stages of the turbine.

Size alone is not the only measure of this installation. The FW steam generator also helps make Unit #3, with a heat rate of 8685 Btu per kwhr, one of the most economical and efficient ever built, producing a kilowatt hour of electricity from less than ¾ lb of coal.

With more than a half century of specialized experience in heat engineering and steam generation, Foster Wheeler will welcome the opportunity to quote on your steam plant units—for any pressure or any capacity. Foster Wheeler Corporation, 666 Fifth Ave., New York 19, N.Y.

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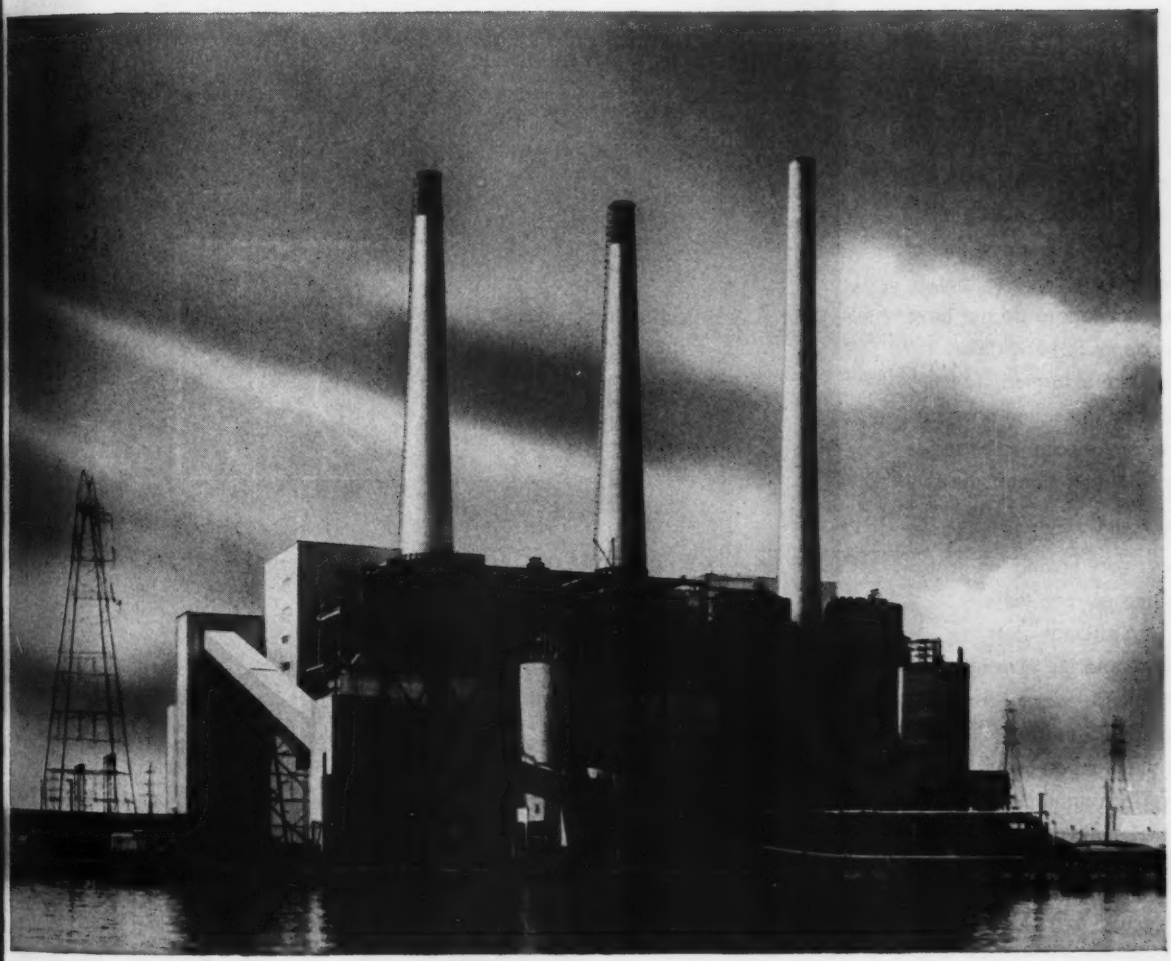
2,000,000 lb/hr

STEAM GENERATOR



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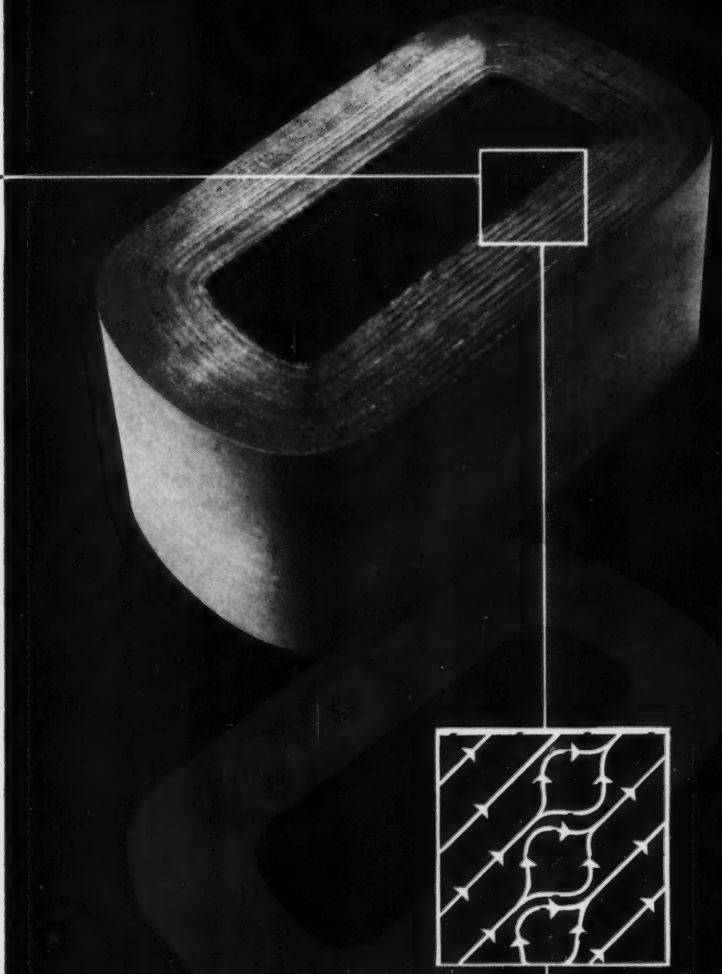
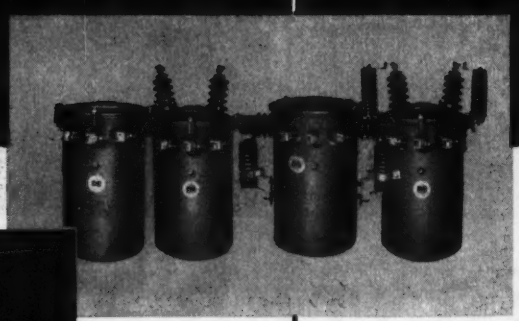
Developed by Moloney engineers for use in distribution transformers, the MOLONEY CORE is made of single-turn, cold-rolled, grain-oriented, silicon steel laminations having the ends butted one against the other. To accomplish a high permeability path for the magnetic lines of force and reduce flux density at the gaps, the butt joints are distributed over one entire side of the core and arranged so that adjacent laminations do not have air gaps opposite each other. After the core is formed, it undergoes an annealing process to relieve any mechanical stresses introduced during manufacture.

The MOLONEY CORE is a compact core having low losses and exciting current, thereby keeping operational costs to a minimum, and is the result of research and development programs dedicated to the continued improvement of Moloney Transformers . . . Specify Moloney Transformers . . . All Along the Line.

MEDS-2





MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers

MOLONEY ELECTRIC

for Utilities, Industry, and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

Editorial Comment

MARCH 23, 1959

Industry Promotion to Hit "Big Time"

It is indeed heartening that the sponsors of the largest general magazine advertisement ever run will be the electrical industry. In the September 14 issue of "Life Magazine," Edison Electric Institute and major electrical manufacturers will team up in a 30-page ad on the All-Electric Medallion Home that will promote electric heating, lighting, wiring, appliances and home modernization.

In this year of big new all-electric campaigns such as EEI's National Electrical Living program and Westinghouse Electric Corp's Total-Electric Home promotion, along with a continuation of the General Electric Company's Medallion Home program, we have further evidence that the industry is out to promote the electric way of living in a big way.

Utilities can tie in with this ad to get full impact. Preprints of the ad will be available for distribution to their customers. This is also an excellent chance for utilities to call attention to the "Life" ad and thus get double mileage out of their promotional efforts. A line such as, "Don't miss the 30-page electrical industry ad in the September 14 issue of Life," would get utility customers to read the ad and impress on them the many ways electricity can serve and benefit them.

We're proud of the industry for this "first" and we're sure people who see the ad will be impressed. But of more importance, we believe it will win new customers for electrical living.

Enhancing Professional Prestige

We have recently observed Engineers Week, an event designed to emphasize the importance of engineers in today's world. We engineers have no doubt about our importance but one wonders if we are going to get very far through activities of this type. One of the serious problems that the American Institute of Electrical Engineers faces is the loss of prominent engineers in Institute activities as they gain stature in their own business life. Far too many men lose interest in AIEE activities when their administrative functions decrease their interest in engineering matters. Is it desirable to hold on to the interest of these men in professional activities?

Since one of the important means of building up the prestige of a profession is through the activities of distinguished citizens, it seems quite obvious that AIEE needs much more support and interest from administrative engineering executives. At the present time we know of no significant programs or activities of AIEE that are of a type to interest these members of the profession. Those who remain interested are primarily the ones who are required to remain informed on technical developments. We submit for your consideration the idea that AIEE should include in its program distinct activities of interest to executives and leaders in the business world who reached those positions through electrical engineering channels. In addition to activities, we should also consider proper designation of their membership grade. Certainly the grade of "Fellow" would be most appropriate. The offer of this grade to these gentlemen would in itself stimulate more interest and provide a better atmosphere to gain their cooperation. It is hoped that we will receive considerable discussion on this subject.

Timely Tactics

Tampa Electric gets $3.80/ton coal price with hopper cars; eastern roads and coal operators shave prices; oil import impact to be slight; coal policy conference formed

QUICK UNLOADING of hopper cars takes place at Tampa's Gannon Plant. Big "car shaker" at coal unloading shed aids in cleaning out cars so that they can be reloaded with phosphate for the return trip to points in north

Utilities generally are coming out ahead on recent fuel developments.

Florida companies, for instance, are expected to benefit from the use of railroad hopper cars which have been returning empty to the Sunshine State after deliveries of phosphate. Consolidated Edison Co of New York, Inc, is the first of a sizeable group of eastern utilities to negotiate lower tariffs from railroads and coal operators. And the consensus last week was that the mandatory oil import program is not expected to have any immediate effect on the price of residual oil.

Tampa Electric Co has been instrumental in working out the use of the closed hopper cars which carry phosphate to fertilizer and chemical plants of the East and Midwest. Instead of returning empty, the cars will carry about ½-million tons of coal a year back to the utility's Gannon Plant at a hauling cost of $3.80 a ton.

"The agreement still needs ICC approval," said W. C.McInnes, Tampa Electric president. If approved, the new price will go into effect in mid-April. It applies to total tonnage, regardless of what type of car the coal is delivered in.

The company now pays $4.15 a ton for coal and $4.66 a ton to haul it. This is equivalent to about 35¢ per million Btu. The new $3.80-a-ton rate will mean a reduction to 30¢ per million Btu.

The development is a timely one for Tampa in view of lower-court litigation that upset the company's 20-yr coal contract (EW, Dec. 1, 1958, p 29). Western Kentucky Coal Co, parent firm of the utility's supplier, was upheld when it declared the contract violated the Clayton Anti-Trust Act. Tampa Electric has appealed the decision to the Sixth Circuit Court in Cincinnati.

Con Edison expects to save about $2½ million during the fuel year that begins April 1 on its new agreement with eastern roads and coal operators. The coal suppliers will cut their price by 25¢ a ton while the railroads will reduce their's 50¢ a ton for shipments exceeding 3-million tons, providing Con Ed buys 5½-million tons during the year. The utility expects to burn from 6 to 7-million tons in the 12-month period.

Two weeks ago, the railroads and coal operators put comparable tariffs on public docket. The lower prices are subject to ICC approval. Affected utilities would include Long Island Lighting Co, Public Service Electric & Gas Co, Delaware Power & Light Co, Baltimore Gas & Electric Co, Philadelphia Electric Co, Atlantic City Electric Co, New Jersey Power & Light Co. The formula may vary from the one negotiated by Con Edison, depending on local conditions.

Discussions on the new price schedules began last September and continued during a period of a relatively large oil surpluses. Con Edison, in fact, proposed to bring in oil from Venezuela to fill its fuel needs, which are equivalent to some 10-million tons of coal a year.

With the introduction of oil import restrictions, this bargaining tool will be dulled for subsequent negotiations with coal operators and railroads, according to both utility men and railroaders contacted by EW.

The general feeling is that the oil program won't immediately affect residual prices, nor will it make residual any harder to get. Rather, it will bring to an end any periods when fuel oil is available in excess quantities. Reduction of surpluses is expected to

Help Keep the Lid on Fuel Costs

stabilize or level off the soft spots in residual prices, say observers in Washington.

Practically no effect on residual oil use will be felt on the West Coast, because producers in that area already are operating at full capacity and still can't meet requirements.

Strongest effect from the new program will be felt on the East Coast, where most of the imported fuel oil is used. Here, imports are estimated to account for 50 to 60% of the residual market from Norfolk north on the Atlantic Coast.

The Oil Import Administration of the Interior Department will operate the program. Nation-wide residual imports are expected to be limited to about 400,000 barrels daily, or slightly less than has been imported in recent years. Incoming fuel oil averaged 488,000 barrels a day in 1958.

No controls or reporting procedures will apply to users of residual fuel oil. The program, to be administered by Capt (Navy) Mathew V. Carson, goes into effect April 1. After June 30, 1959, import levels and allocations will be made on a six-month basis.

Meanwhile, a strike by United Mine Workers in Eastern Kentucky—a supply point under the Tampa Electric agreement—may pose problems for other utilities dependent on the area's coal. Harlan County mines closed last week and other unionized fields were expected to close. The landlocked mine operators contend they cannot pay the demanded wage, plus 40¢ a ton to the UMW welfare fund, $200 a year vacation pay, and still set competitive prices, especially with mines having waterway facilities.

It is problems such as these that will be the concern of the recently formed National Coal Policy Conference. Patterned after a suggestion of John L. Lewis, UMW president, the group is comprised of the UMW, bituminous coal operators, coal-carrying railroads, coal-burning utilities, and some of the coal industry's equipment suppliers.

Purpose of the NCPC will be "to advance and promote the interests of the industry on the broadest possible front," the group announced. Its chairman is George H. Love, board chairman of Consolidation Coal Co. Executive director is Joseph E. Moody, president of the Southern Coal Producers Assn. Philip Sporn, president of American Electric Power Service Corp, is a member of the executive committee.

Among its objectives the NCPC lists a nation-wide educational program on coal's importance to the national welfare; broadening of markets; research on utilization of coal; and "action to end extravagance and waste in the program to develop civilian atomic energy here and abroad."

Faced with declining U. S. consumption (631-million tons in 1947 vs 400-million tons in 1958) and prices "approximately what they were 13 years ago," the industry was not displeased to learn of the oil import quotas. The NCPC said residual oil is being imported at a rate equivalent to 41-million tons of coal annually. The new quota will cut this to 37-million tons.

Curb on All Ad Expenses Sought in California

A bill introduced in the California legislature provides that cost of any advertising or literature mailed or delivered to users of gas or electricity shall not be included as operating expense by the Public Utilities Commission in fixing rates.

Spokesmen for the utilities in the state capital say both Pacific Gas & Electric Co and Southern California Edison Co will fight the measure, although no public statements have been issued.

Strong opposition from other quarters, including newspaper editorials, has led observers to believe the measure will be killed in the assembly's Public Utilities and Corporations Committee. A hearing is expected to be set some time after March 25.

At the time he introduced the bill, Assemblyman Philip Burton, a San Francisco Democrat, said it was aimed at such practices as PG&E's mailing of literature to customers, and at ads in newspapers favoring partnership on the Trinity River hydro project.

As introduced, however, it was a much broader bill which would affect all advertising—even direct mail pointing out advantages of using electricity or gas, and newspaper ads with similar messages.

Target Is Private Companies

Burton frankly declared the measure was aimed at private power companies:

"The bill will prevent the PUC from permitting private power companies from passing on to the consumer their costs of advertising.

"This problem came to light when the Pacific Gas & Electric Co spent tens of thousands of dollars attempting to huckster the people of California and the federal Congress into accepting the so-called partnership program on the Trinity River."

One utility representative observed: "We feel pretty sure this type of legislation would be unconstitutional if tested in the courts."

Among editorials that followed the bill's introduction, the San Francisco Examiner cited figures on how advertising has helped expand gas and electric sales, thus reducing unit costs. The ads also help encourage new industries and build investors' confidence in enterprise in the state, the editorial said.

"Such facts expose (Burton's) AB 1668 as a thoroughly bad bill, based on a false image of the roles of both utilities and advertising. It is utilities-baiting and business-baiting to serve demagogic ends, and should be rejected as such," the newspaper concluded.

The measure does not mention railroads, telephone companies or other utilities.

This battery powered Chevy may point the way to . . .

'Electric' Power for Any Car

The motor-weary auto of tomorrow may not head for the scrap heap so soon, if Electric Equipment & Engineering Co of Denver, Colo., has its way. The firm will by mid-year offer "a complete kit to convert any present automobile into electric drive," says A. J. Morroni (above), general manager.

The company has converted a 1955 Chevrolet to obtain engineering data, and is working on refinements of this endeavor. The car uses a 5-hp motor, which the company makes, to replace the engine and transmission.

Goal Is 100-Mi Range

"Test results were more than gratifying," Morroni says. Speeds up to 45 mph are achieved with the 4,200-lb (including batteries) Chevy. "Our goal is to reduce the weight and, with nominal battery improvement, obtain speeds up to 60 mph and a 100-mi range on each charge."

The battery charger is a built-in silicon rectifier, requiring little space. The firm made the charger itself, using Westinghouse silicon cells. It is around 95% efficient, 50 amp at 100-v output, and has two terminal plugs permitting input of either 110 or 220 v. A full charge will require 6 to 7 hr.

The battery in use now is 96 v, 130-amp hr at an 8-hr rate. Control is by means of magnetic contactors operated through pilot controls, which in turn are operated by the existing foot accelerator. Exide will supply the firm with an experimental battery in the next few months, which may help boost driving speed and range.

The company is now designing a rear axle using two specially designed 5-hp motors, each driving one rear wheel. An improved amp-hr meter also is being designed.

The kits are being designed to convert mainly Plymouths, Fords, and Chevrolets. No estimate on the kit's cost is available because that will depend upon volume production, the company explains. A heavy flow of orders is expected once the kit is perfected. It will take about one day to convert a car.

Electric Equipment employs ten men. Basically, they produce custom-built electrical controls and power equipment. The firm was the first to apply electric dynamic braking on diesel electric locomotives.

With the present battery, driving range was calculated at 15 mi. Tests brought a range of 16-18 mi per charge of 14 kwhr, or about 1.3 mi/kwhr.

Big Share of Urban Market Seen

Morroni, while emphasizing that considerable work must be done before the electric car is accepted on a large scale, said he and many other engineers share the views of Edison and Stienmetz on the superiority of electric vehicles. "We are confident that by 1970, fully 50% of the automobiles used in urban areas will be electrically propelled."

The U.S P

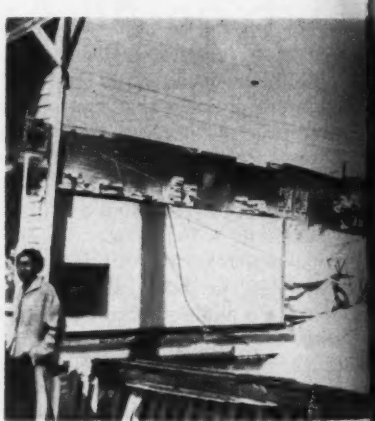
BPA-Pacific G&E Agree on Initial Intertie Points

Preliminary agreement on several points of a proposed intertie between Bonneville Power Administration and Pacific Gas & Electric Co was reached March 11. The energy under consideration is surplus dump power, mainly available during May and July.

Officials of PG&E, California Oregon Power Co and BPA took part in the discussions. A hearing on the proposals has been set for April 8-9 by a Senate irrigation and reclamation subcommittee. Interior Secretary Fred Seaton will review the proposals also.

Seaton has been asked by Sen Clair Engle (D-Calif.) to postpone negotiations on the interconnection until after the April hearings. Engle said he understood a contract might be signed before then. "Let's not concede the ball game before the other side has had a chance at bat," he said. Engle prefers a federal tie

Midwest, Memphis Hi



MEMPHIS: 100 mph gusts

It was a busy spell for linemen as March lived up to its lion-like billing in the Midwest and Memphis, a truck ran wild in Albert Lea, Minn., and a Palouse, Wash., bobcat escaped pursuing dogs the hard way.

Iowa and Wisconsin were hit

between BPA and Bureau of Reclamation lines in the Central Valley Project.

Points on which PG&E-BPA agreed are: **1.** Marketing of surplus secondary power would be on basis of 10-yr contract at BPA's regular dump rates. **2.** COPCO would wheel the power; PG&E and COPCO would build additional 230-kv to close a 90-mi transmission gap from Klamath Falls, Ore., and Pit River, Calif. **3.** COPCO-BPA interconnection would be at Reston, Cottage Grove, and Yamsay, Ore. **4.** BPA would be able to use the wheeling facilities for emergencies.

New TVA Line to Have 460-kv, 7-Mi Section

A 7-mi section of 460-kv construction is to be part of TVA's 60-mi Johnsonville-Lawrenceburg 161-kv transmission line, which will be built soon. Purpose of the 460-kv section is to evaluate costs and engineering problems and accumulate experience, Merrill De Merit, chief power engineer, told EW.

Large, rapidly growing loads make the economies of extra-high voltage of special interest to TVA for the future, he said. TVA expects to complete the 460-kv link in 1960. It will include steel structures proportioned for 460 kv, and supporting bundled conductors. Operation will be at 161 kv for the present.

Door Ajar on New York Power Plant Sale Approval

The New York City Board of Estimate last week approved the sale of the three city-owned power plants to Consolidated Edison for $125,840,000, but at the last minute opened the door to competing offers.

The Board added an amendment to the contract which allows it to consider competing offers. The sale of the plants will not become final until an auction is held in May. The amendment to consider other offers is the result of a statement made earlier in the week by New York lawyer Harvey Spear that a group he represents is planning to make the city a better offer. This group is reportedly headed by Roy O. Chalk, New York industrialist, owner of Washington's Capital Transit Co, and President of Trans-Caribbean Airways.

Yankee Hearing Set

Financing of the Yankee Atomic Electric Co plant will be the subject of an April 9 AEC hearing. It will explore the company's plan to sell $20 million of 5% first mortgage bonds due in 1982. The remaining funds for the plant will be obtained by selling $20 million in stock and by borrowing $17 million from banks. AEC will pay $5 million on research, development.

Hit By Storm; Linemen Handle the Unusual With Aplomb

IOWA: Twice in two weeks

ALBERT LEA: Truck trouble

PALOUSE: A new trophy

hardest by snowstorms that buried much of the Midwest the second time in two weeks. Service interruptions were relatively few, however, for most electric systems.

Wind gusts of up to 100 mph swept through Memphis causing outages on primaries and a 12-kv line of the Light, Gas & Water Division.

The run-away Albert Lea truck clipped off a 55-ft pole carrying three guys and three sets of primaries. Both 2,400 and 4,160 v circuits and the street light feeder circuit were out 5 hr until Interstate Power Co crews set a new pole.

Washington Water Power Co Linemen Littleton and Porter theorized that their "safari" trophy was electrocuted when forced by dogs to climb the pole.

TVA Bond Bill Passed By House Unit

Public Works Committee votes 19-14 on measure that includes definite area limitations; option for 'frontier' cities

A bond financing bill for Tennessee Valley Authority—including definite boundary restrictions—was approved 19-14 last week by the House Public Works Committee.

The new area limitation clause in the bill was proposed by Rep Carl Vinson (D-Ga.). It would limit the TVA service area to the territory it served on July 1, 1957, except for economically feasible power exchanges—existing prior to that date—with other utility systems.

A second amendment to the area limitation clause, proposed by Rep Russell Mack (R-Wash.), also was adopted. Mack's amendment, however, would specifically permit eight towns outside the 1957 area to receive TVA power if they desire. These are Paducah, Princeton and Glasgow, Ky.; Dyersburg, Covington and South Fulton, Tenn.; and Chickamauga and Ringgold, Ga.

The original bill (HR-3460), introduced by Committee Chairman Clifford Davis (D-Tenn.), called only for an "area limitation" within counties now wholly or partially served by TVA or lying within the Tennessee River drainage basin, plus additional TVA service to rural co-ops. This language generally was conceded to permit the TVA to expand from its present 80,000 sq mi to an eventual 105,000 sq mi.

$750-Million Limit Set

Other provisions of the bill are: **1.** A $750-million limit on total bonded indebtedness. **2.** A 15-day notification period to the Secretary of the Treasury for proposed new bond issues plus a 45-day delay period by the Secretary if he wishes. **3.** Congressional disapproval of bond-financed projects within 90 days. **4.** A required minimum payment of $10-million annually to the U. S. Treasury on TVA's unappropriated funds.

Vinson insisted that the original Davis bill should be amended to block the "uncertainties, ambiguities and loopholes" in the area limitation wording. Definite limitations, Vinson pointed out, would end a 20-yr period during which the only restriction was a "gentlemen's agreement" between the authority and contiguous private systems that TVA had no further plans to expand its service area.

Harllee Branch, Jr, Southern Co president, testified that the "gentlemen's agreement" between his company and TVA was better than no agreement at all. He said, "The language in HR-3460 will seriously becloud, if not completely invalidate, the 'gentlemen's agreement' which has existed . . . for about two decades. This would produce such uncertainty and uneasiness among investors, as to seriously jeopardize our companies' ability to finance—except at prohibitive costs—the new facilities which will be required . . . in the four states where we serve."

Branch dwelt on assertions by TVA spokesmen that the authority doesn't wish to expand. "If this is a true statement of TVA's desires and intentions, and I have every reason to believe that it is, then I see no reason why anyone should object to placing a clear-cut limitation to that effect in the bill."

Louis V. Sutton, president of Carolina Power & Light Co, criticized the need for a bond financing bill. "Actually it does not appear that TVA needs additional capital funds," he said. "At the end of fiscal year 1958, TVA stated it had $66 million of cash on hand. In the next three years it should generate at least $100-million per year out of its business. This means that over $350-million cash will be available for construction and repayment.

TVA Is 'Long' on Power: Sutton

"TVA is also 'long' on power," Sutton pointed out. "Scheduled additions of several million kilowatts will increase the TVA area generating capability, including the Memphis plant, to 13.4-million kw by 1960. The AEC load has stopped growing. TVA has a winter peak, due to the large heating load. Its February, 1958 peak, including a large amount of interruptible power, was 9.4 million kw. Thus TVA will have available approximately 4-million kw of power to grow on."

R. M. Watt, board chairman of Kentucky Utilities Co, insisted, "A boundary line must be fixed at some time unless the TVA area is to eventually extend to cover unlimited areas in southeastern U. S. and possibly elsewhere. There exists today not only a threatened, but an actual, taking of (KU) properties by expansion, and proposed expansion, of the TVA service area." He cited these examples:

- South Fulton, Tenn., where KU "has served since 1917, a neighboring municipal electric system (Weakley County Municipal Electric System) has been granted a franchise to build facilities and distribute TVA's energy in the city (EW, March 16, p 51) . . ."
- In three other cities served by KU — Paducah, Glasgow, and Princeton, Ky.—"Steps have been taken to acquire the company's facilities solely on the basis that thereby TVA power will be made available to those communities."

Coal industry spokesmen opposed the bill because of "unhappiness" with TVA's coal-buying policies.

AEC Invites Proposals for Superheat Reactor

April 20 is the deadline for industry proposals for engineering development work leading to an advanced power reactor using nuclear superheated steam. The AEC invitation calls for a cost-type contract for the project.

The program would concentrate on engineering development data for the most promising design criteria and the most practical use for nuclear superheat reactors. Higher steam temperatures could lead to a simplified turbine and associated equipment, thus reducing turbine costs, the AEC said. Increased plant efficiency and reduced fuel burnup also could lower fuel costs.

BUYING TECHNIQUES PANEL features (l. to r.) Marshall Pease speaking on centralized purchasing; Frank Baxter, on decentralized ordering; Robert B. Gear on mechanization; James J. Cuniffe spoke on the function of expediting

Advance Buying Argued at PA Meet

Centralized buying vs decentralized ordering is explained. Buyers told planning is important function. What does expediter do in these times? More mechanization advocated

Advance purchasing of heavy electrical equipment may well be justified in specific cases, but each decision will depend on discounts given, storing and carrying charges that may accrue. This was gist of a paper given by Malcolm Davis, vice president, Gilbert Associates, before the mid-winter conference of the Public Utility Buyers Group in St. Louis.

Nearly 200 buyers attended this 28th annual conference to hear utility and manufacturing executives discuss purchasing techniques and problems ranging from mechanization of placing orders to ethics of purchasing agents. While open controversy was shunned, individuals expressed views differing from those of the speakers.

In his discussion of advanced buying, Davis chose a sample piece of equipment with an assumed discount offered for purchase 18 months ahead of actual need. He noted that both cost of advance investment and cost of storage must be taken into account in calculating the cost of the equipment at the time it is needed.

Several buyers questioned Davis' calculations, arguing that average cost of money to the utility should be used in figuring the carrying charges on the idle piece of equipment. Davis had used the cost of debt money in his calculations.

Responsibility to Increase

J. Wesley McAfee, president, Union Electric Co, told the buyers that rapid growth of electric utilities will greatly increase the responsibility of purchasing departments. A primary responsibility of utility buyers, he said, is to plan for long-term purchasing—to make sure that supplies will be available in needed quantity and at reasonable cost many years in the future.

In the case of fuel supply, McAfee continued, this may require thorough study of sources of supply, methods of coal mining, and various means of transportation.

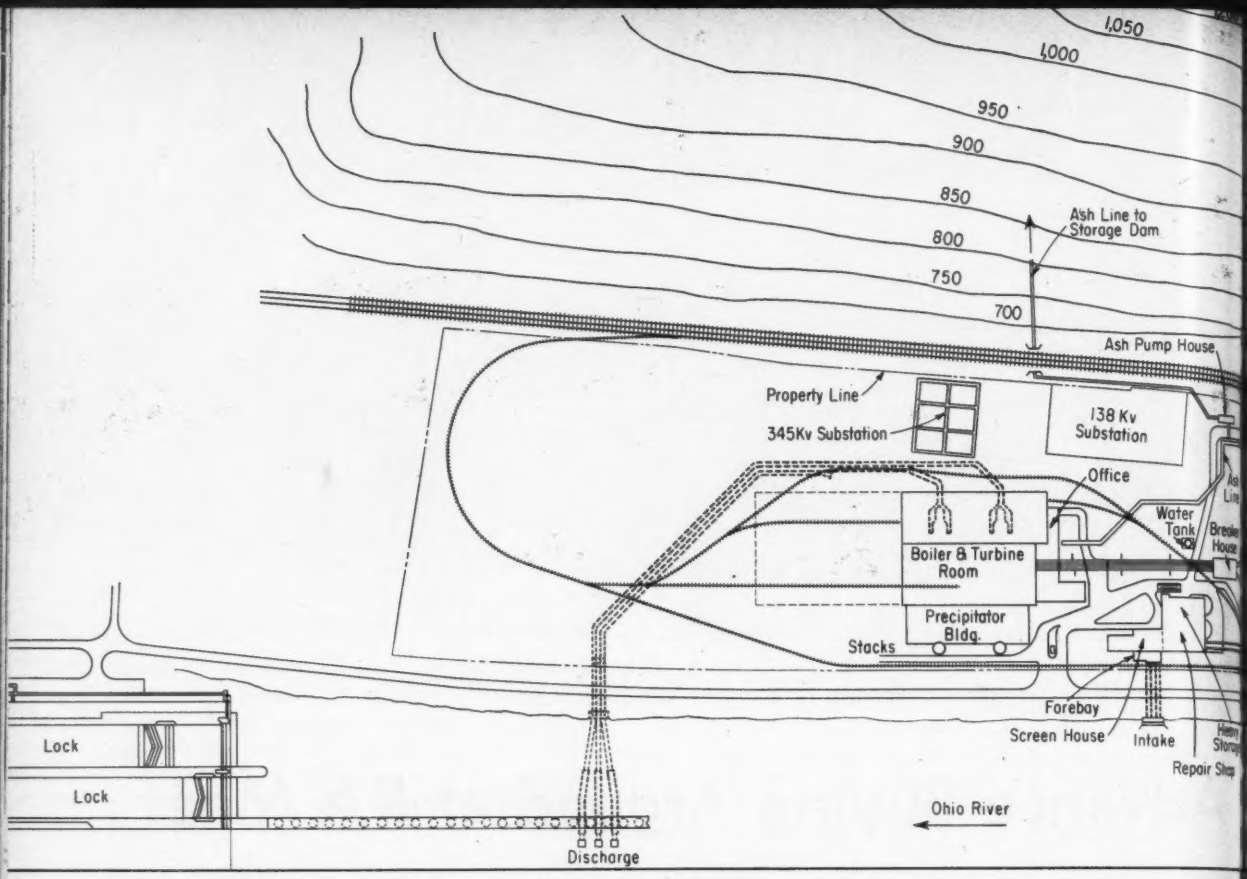
As for his own company, McAfee said, "We are not looking for suppliers that can't make money and keep strong. Short term cut-rates doesn't offer very much for us. We're in business for the long term and we must pick suppliers that will be with us."

One unsolved problem posed by McAfee: How much favor should be shown to suppliers in the utility service area—those that are customers as well as suppliers? He offered this guidance: Deal with your customers, but on a fair basis.

Joseph L. Singleton, president of National Electrical Manufacturers Association and a vice president of Allis-Chalmers Mfg Co, emphasized the importance of research and development to industry progress. He pleaded for the cooperation and understanding of utility purchasing men in carrying on and expanding industry research. "This calls for teamwork," he said. "All of us must assume responsibility for progress."

The NEMA President told the PA's they should buy to the best advantage possible, but urged them to consider all aspects before determining the best value. He also urged the buyers to carefully study

(*Continued on page* 100)



OHIO RIVER AREA for joint development is 800 ft wide at Stratton Station, and about one mile long. Parallel con-

Utility, Other Agencies Cooperate In

Ohio Edison shares benefits of joint planning for new Stratton Plant, dam and lock project, road improvement

A. CARNEGIE, In Charge of Production & Transmission, Ohio Edison Co, Akron, Ohio

J. H. FOOTE, Chief Engineer, Commonwealth Associates, Inc., Jackson, Mich.

The construction of Stratton Generating Station involved Ohio Edison Co in a joint development scheme which proved beneficial not only to the utility, but also to two cooperating agencies. Each gained from the planning and detailed arrangements to meet their mutual and separate needs.

The new plant is on a 110-acre site only 800 ft wide but about a mile long.

Following World War II, Ohio Edison selected river frontage a few miles upstream from its Toronto plant for a new generating station. The site is near transmission facilities. At the time, the U. S. Army Corps of Engineers was seeking an Ohio River site for construction of a new dam with locks for navigation to replace three older ones.

An additional factor in the riverfront development was the Ohio State Highway Department's need for straightening and improving a main north-south highway paralleling the river bank. All three parties got together to solve the problems arising from their overlapping interests, and this extra planning has since paid off.

Joint Planning Needed

Elements of the problem of joint development were these:

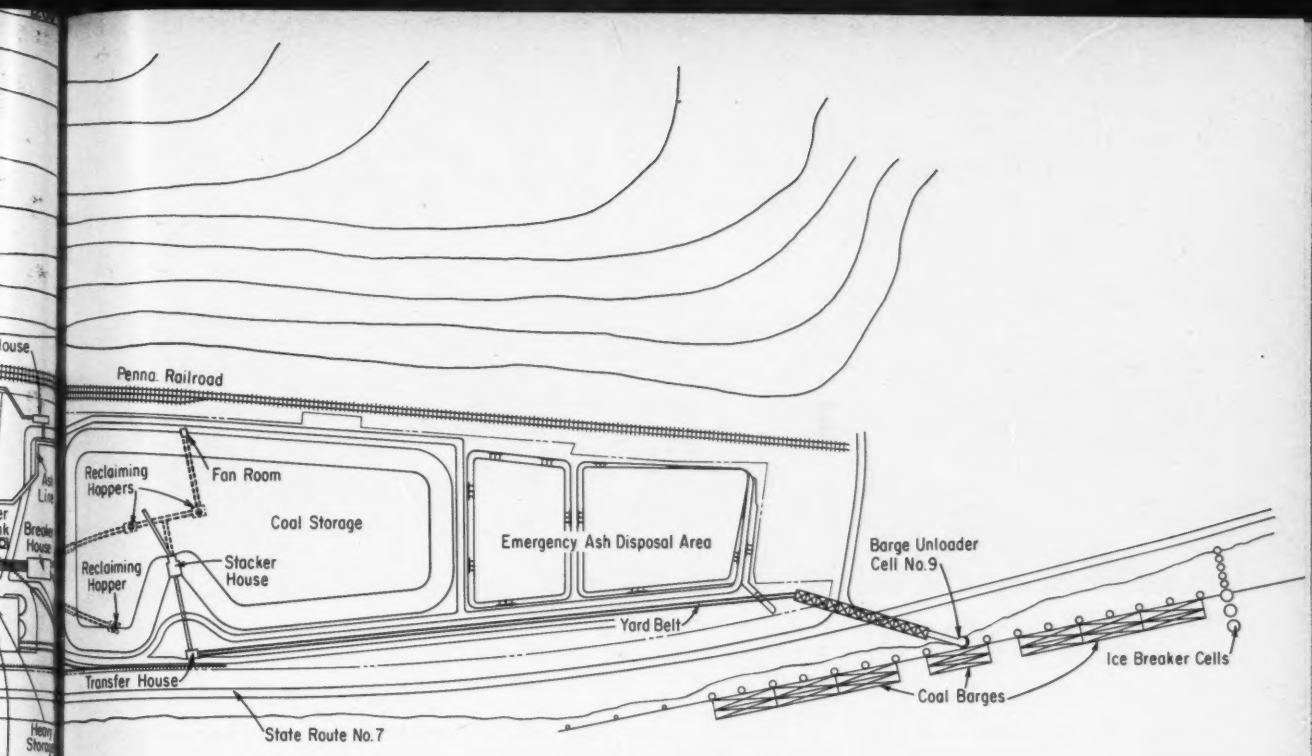
1. Barge docking and coal unloading arrangements had to allow a clear sailing line for river traffic through and above the lock.

2. Condensing water intake and discharge had to be from the pool above the dam to take advantage of the lesser variation in water level, and yet it had to go beneath the lock channel to avoid turbulence in the lock approach area.

3. More than 1-million cu yds of earth excavated for lock and dam construction had to be disposed of and, at the same time, basement excavation and yard fill for the plant and its substation had to be cared for. Timing, as well as specific locations for dumping of spoil, was important in minimizing handling costs.

4. Highway relocation and coaling facilities had to be such as to avoid interference from coal-handling structures within the clearance and curvature criteria for modern highways.

The solutions of these problems



struction of locks and dams restricted plant layout. A railroad and steep hill constituted other limitations

In Ohio River Front Development

netted advantages to all parties. Earth from dam and lock excavation was advantageously disposed of; the power plant site grade was brought up above high water; the power plant pumping head was reduced; the highway alignment is satisfactory; and, the sailing line on the river is maintained as dictated by navigation requirements. These happy results took much study and some compromises, individual features absorbing their quotas of disadvantages. Yet overall results were attractive and economical.

Scheduling of various construction phases was of particular significance, and the fine cooperation among the several engineering and construction teams resulted in success.

Initial planning had included two generating units for the plant. But by the time construction started, the company determined that two additional units should be included in a program of continuing construction to meet system load growth requirements.

Stratton's first unit is scheduled to go into service this summer. The other units are expected to be ready for service in the summers of 1960, 1961, and 1962, respectively.

Turbine-generators have a guaranteed gross output of 185 Mw at 1½-in. back pressure and 175 Mw at 3½-in. back pressure. The units are 3,600-rpm, tandem-compound, triple-flow type with steam conditions of 2,400 psig, 1,050F and 1,000F reheat. Calculated annual heat rate of the plant is 9,150 Btu per net kwhr.

Larger generating units, as well as their location at other plants of the company, were considered in lieu of the third and fourth units, but planning studies indicated that units of the same rating in continuing construction offered marked advantages in investment charges and in meeting generating reserve requirements.

Steam generators, with a guaranteed output of 1,375,000 lb of steam per hour, are of the balanced furnace design. Two half-size airfoil design forced-draft fans will supply the combustion air, and two similar induced-draft fans will remove combustion products. Electrostatic precipitators will be provided with each unit.

Sailing Line Maintained

Maintenance of a clear sailing line above the lock necessitated siting large unloading facilities at a considerable distance upstream from the lock, where a bend in the river bank will separate the barge unloading operations from the lock traffic. An enclosed overhead galley conveyor, 383 ft long, is used to cross the highway from the barge unloader.

An open conveyor will parallel

UPSTREAM VIEW shows Ohio River front development and future coal storage area. Barge unloading will take place above bend in the river at right center of the picture. This provision allows a clear sailing line for traffic on the river

the highway for about 1,700 ft, where coal will again be transferred to a cross conveyor connecting to the boom house for discharge to the reclaiming hoppers, or to the storage pile. The conveyor paralleling the highway will be left open. Conveyor belts are 54 in. wide running at speeds of 425 fpm and have a capacity of 1,200 tons of coal per hour.

A disposal area for fly ash is being developed in a ravine not far from the plant. The ravine will be blocked with an earth-and-rock fill about 100 ft high for the first level. It will provide about ten years of storage for the four units, and can be raised in height for more storage later.

Dry fly ash will be blown at 15 psi through through a pipe 1,500 ft to a pump house, where it will be converted into a 10% slurry. Six pumps in series will provide a 600-ft head for lift of the slurry through nearly a mile of discharge line to the storage area. The ash-handling facilities are being designed so that provision can be made on the plant site for dry bulk, bagged or processed fly ash.

Bottom ash will leave the plant as a slurry through a 12-in. pipe to two 300-ton ash hydro bins for storage and separating out the water. This capacity provides for weekend operation without unloading. Damp (decanted) ash will be removed by truck.

A divided 5-acre area will be used as emergency fill pond for both the fly-ash and bottom-ash slurry.

Transmission for the first two units will be at 138 kv for connection to the present system. Units 3 and 4 will transmit over 345-kv lines to the central load area of the company, about 75 miles northwest of the new plant. One 345-kv line is now under construction, using a newly developed narrow base tower and conductor arrangement (EW, March 11, 1957, p. 92).

Design Is Compact

The limited space available at the plant required a compact design for the 345-kv substation. Initial construction will accommodate two transformer and two line connections. A breaker-and-one-half scheme will be used, the design being confined to a space of 210 by 260 ft, exclusive of the step-up transformers. Overall height of substation steel is about 125 ft.

A basic insulation level of 1,300 kv was adopted for the design. Minimum phase-to-phase bus clearances are 175 in., and minimum phase-to-ground 129 in. Centerline spacing of buses is 20 ft. Step-up transformers, rated at 205 Mva FOA, are delta-connected on the 20-kv side and wye effectively grounded on the 138-kv and the 345-kv sides. All 345-kv circuit breakers are rated 1,600 amp, 25,000 Mva interrupting capacity and are equipped with pneumatic mechanisms. They are 3-cycle breakers suitable for 20-cycle reclosing.

Substation design includes lightning stroke diverters with overhead line ground wires extending over the substation structure. Line entrance gaps will be used on each incoming line, set to coordinate with the station insulation.

Two chimneys for the four generating units extend 500 ft above ground level. Construction is of concrete with an inner top diameter of 21 ft. The concrete shell has a 4-in. brick lining with 2 in. of fiberglass insulation.

All plant equipment and auxiliaries are totally enclosed with a total building volume of 24.0 cu ft per kw of turbine rating for boiler room, turbine room, precipitator room, and electrical bay. The electrostatic precipitators and induced-draft fans are at grade elevation in a building adjoining the boiler room. Building construction is with steel panels inside and aluminum fluted panels outside. The steel and aluminum are erected in separate operations with 1½-in. insulation between.

The present estimated cost of the completed four-unit generating plan is approximately $118-million including site development and connections to the step-up transformers, but not including the outdoor transmission substation.

Penta-Treated Poles Endure

Inspection, supplementing analysis, shows penta-treated poles remain in excellent condition after 17 years of service

WILLIAM H. FERRIS, Chief Electrical Engineer, Wisconsin Power & Light Co, Madison, Wis.

After 17 years of service, 202 penta-treated "clinical" poles of Wisconsin Power & Light Co are in excellent condition and have many years of service life remaining. This condition, established by visual inspection, seemed evident in earlier analyses of nine poles.

Most of the poles were installed in rural areas, in the company's Mineral Point District early in 1942. Of the original 558 poles, 300 have been positively identified and located in line and 202 were selected for periodic checking because of their accessibility.

The poles were penta-treated by Joslyn Supply & Manufacturing Co, Franklin Park, Ill., whose records show that 38 were treated in October 1941 and 520 in December 1941. Most poles were Class 7 and 30 ft long. Every pole was bored and, in most instances, 100% of the sapwood was penetrated. The poles were air seasoned, treated according to this schedule:

1. Poles were steamed for about 8 hr at a pressure up to 20 psi at 259F.
2. Moisture was extracted in a vacuum at 24 in. Hg for about 4 hr.
3. An air pressure of 60 to 70 lb was introduced into the wood.
4. The pole was impregnated over about 3 hr at 160 to 170 psi and 145 to 165F.
5. It was then subjected to a vacuum of 22 in. Hg up to 1¼ hr.

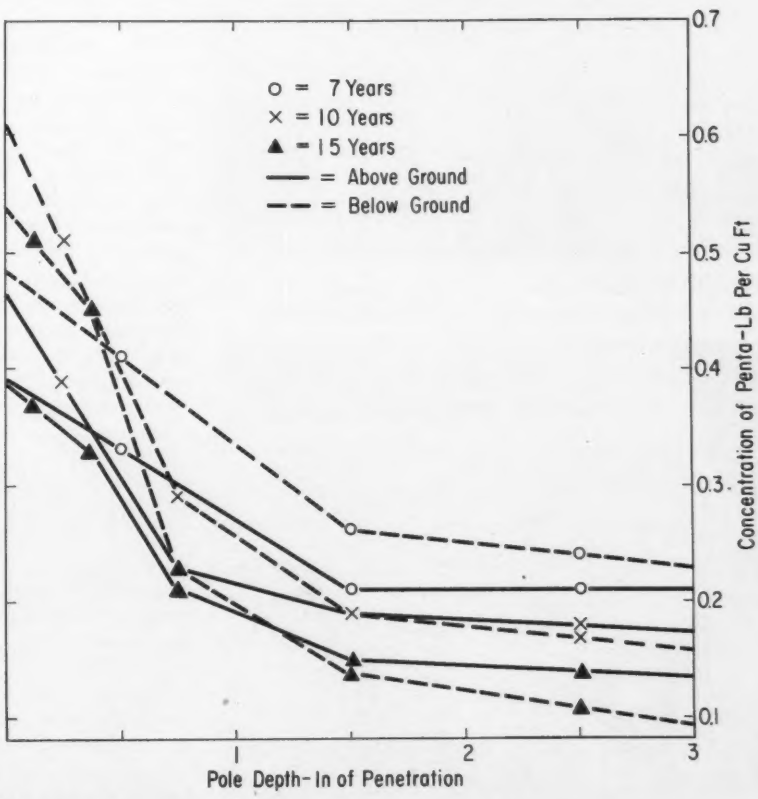
The percentage of oil components in the penta carrier varied. One record shows a mixture of 25% Shell Oil Co No. 8198 and 75% Engine Distillate from the Standard Oil Co of Indiana. Another indicates Joslyn's penta carrier used in 1941 consisted of 50% Standard Oil Engine Distillate and the balance about a 50-50 mixture of Shell 8171 and 8198. It is not expected that such oil would meet present-day requirements.

The percentage of penta reported by Dow's Analytical Laboratory in February 1942 was 4.61% based on total chlorides using a Parrbomb and a Volhard method. This analysis was on oil samples from Joslyn.

Ten poles were located, inspected, and had increment borings removed both above and below the ground line in 1949, 1952, and 1957, or at completion of seven, ten, and 15 years of use. In 1953, 200 poles were inspected, the ground having been removed to 12 to 18 in. When probed and sounded, 196 showed no signs of decay. Later inspection of the other four showed them free of decay also.

In July 1957 nine of ten poles bored twice earlier were bored again. Three borings were taken about 4 ft above ground and three about 3 in. below ground. These 3-in. borings were sectioned, starting at the pole's surface, into ¼, ¼, ½, 1, and 1-in. pieces. The borings at each depth increment were composited to make a total of ten analytical samples per pole. Results showed very little change when compared with previous borings, and the surface concentration of penta was still above the level which promises long additional life.

In July 1958, 202 poles were examined. Only two warranted further examination because of small surface soft spots below the ground line. Careful laboratory examination of the wood from the ground line of these poles revealed no evidence of the presence of wood-destroying organisms.



RESULTS of analyses on ten poles after various periods of continued use are presented in terms of the preservative. Most poles are Class 7, 30 ft long

Microwave Ties

Tampa's 5-station system provides reliable supervisory control over all substations

A five-station microwave system ties together Tampa Electric Co's operational centers, business offices, and its vast mobile radio fleet—this in addition to providing reliable supervisory control over its substations.

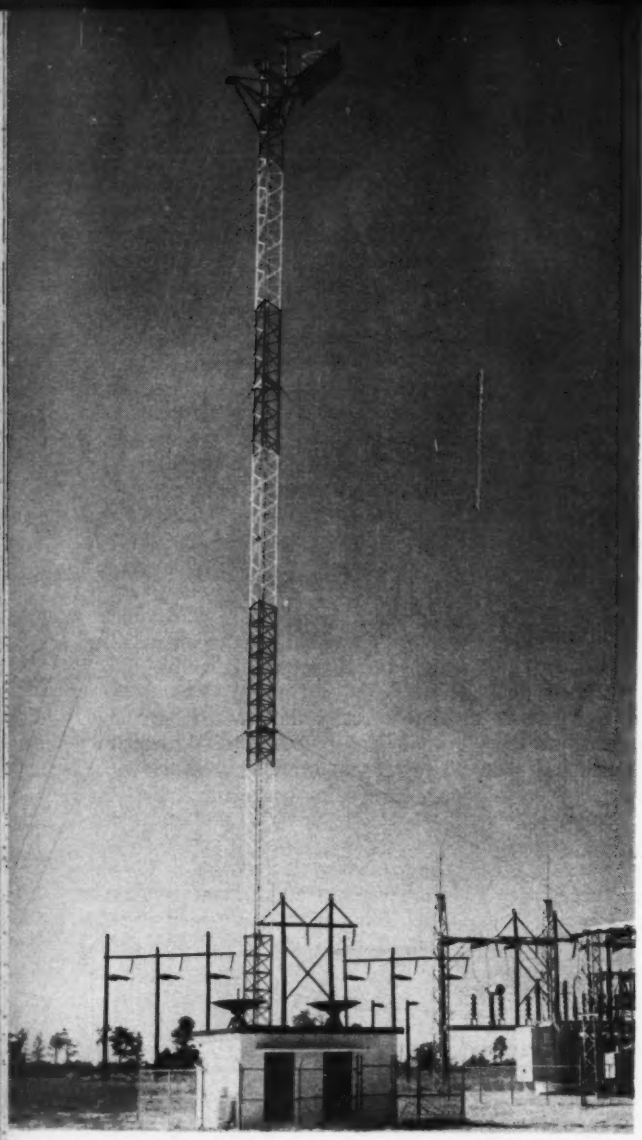
Completed last November, the system is an operational fixed, hot standby system, providing 17 channels, fault alarm, and service channels between Tampa and the stations at Plant City, Dade City, Sandhill, and Winter Haven. The system is expandable to 120 channels. Each microwave station—junction, repeater, or terminal—operates on a 115-v ac primary power source and has an auxiliary standby power generator.

Radio frequency receivers operate in the 6,000 mc band, supplying a wideband baseband signal output for the carrier equipment. Transmitters generate a microwave RF signal carrier in the 6,000-mc range, frequency modulated with a nominal carrier deviation of ± 3 mc. The integral waveguide section permits stacking of up to eight transmitters and receivers. In this completely synchronous installation, all carrier frequency generation equipment is "locked" to a master oscillator with provisions for any Tampa Electric station taking over as master station during a partial system outage. Frequency stability of the carrier system is ± 1 cps.

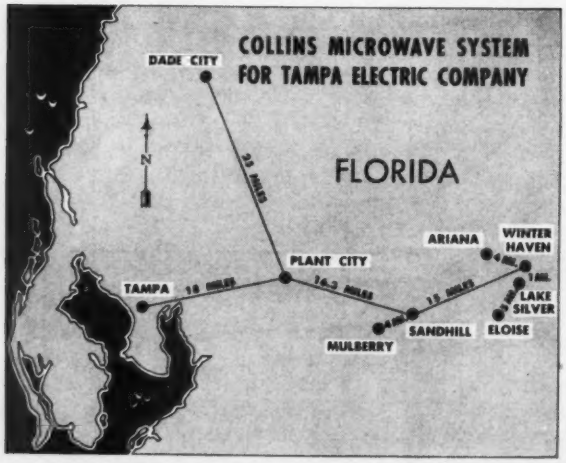
Voice multiplex separation is by means of filters, and fault-finding equipment tones are impressed directly on the baseband, thus avoiding interruption of the carrier channels. The channeling equipment uses a single sideband suppressed carrier multiplex system, which allows use of statistical loading techniques, providing many more usable channels. Each voice communication channel has a bandwidth of 200 to 2,900 cycles ± 2 db.

Tampa Electric arranged with Collins Radio Co for the path surveys, towers, antennas, and microwave RF and carrier equipment. Collins also installed the equipment. The installation is designed so that the main system dispatcher at Tampa can control completely all the company's activities throughout the 1,700-sq-mile area. The dispatcher can control power flow, opening and closing of oil circuit breakers, calling for selective telemetering readings, and closing and opening of switches at distant substations.

The microwave system also links the firm's business offices by telephone. Through its PABX, Tampa Electric provides service for its purchasing, engineering, sales, accounting, and personnel departments. The microwave system is interconnected with Tampa Electric's VHF radio system. This last provision allows the system dispatcher at Tampa to contact other company dispatchers directly and affords contacts with all of the company's mobile fleet. By using VHF radio facilities, the Tampa dispatcher can control substations not under direct supervisory control through the microwave system itself. There are more than 90 substations in the system.



REPEATER STATION is shown against the background of the Sandhill Substation; it's system's only repeater station



MICROWAVE SYSTEM of Tampa Electric Co passes through four Florida counties—Hillsborough, Polk, Pasco, Pinellas

System's Operational Centers

A breakdown of the 17 microwave channels available follows:

Plant City. Three channels are dropped. These are for downtown business office communication, supervisory control for ten functions at the Plant City substations and mobile VHF radio.

Dade City. Four channels are dropped. Two are for business office communications; one for supervisory control of ten functions at the Dade City substation; one for mobile VHF radio.

Sandhill. Two channels are dropped. One is for ten supervisory control functions at Mulberry substation, and the other for the same at Sandhill sub.

Winter Haven. Six channels are dropped. Two are for business office communication, one for VHF radio operation. One is for ten supervisory control functions at the Lake Silver substation; one each for ten supervisory control functions at Airana, and Eloise subs.

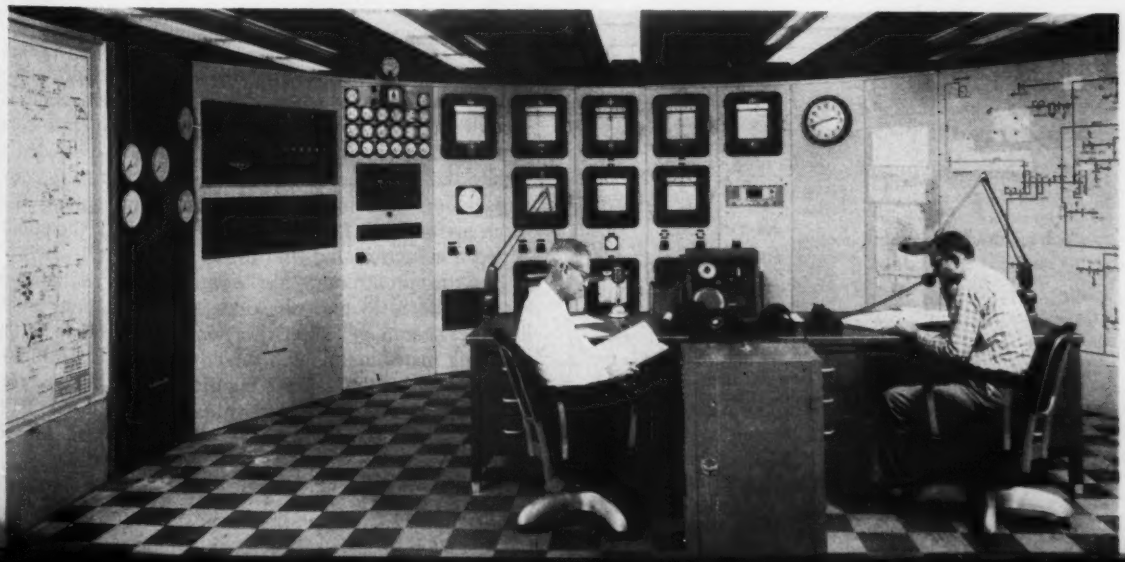
Two party-line channels for dispatching and storeroom communications at Plant City, Dade City, Mulberry, and Winter Haven operations centers made up the total.

Throughout the system 6-ft parabolic type antennas are used. At Tampa, there is a 6-by-8-ft passive reflector on a 160-ft tower; at Dade City, a 10-by-15-ft passive reflector on a 290-ft tower at Plant City, three 6-by-8-ft passive reflectors on a 160-ft tower; at Sandhill, two 6-by-8-ft reflectors on a 140-ft tower; and, at Winter Haven, a 6-by-8-ft passive reflector on a 110-ft tower.

Frequencies used are Tampa to Plant City, 6,585 mc transmit, 6,755 mc receive; Plant City to Dade City, 6,795 mc transmit, 6,625 mc receive; Plant City to Sandhill, 6,835 mc transmit, 6,665 mc receive; and Sandhill to Winter Haven, 6,585 mc transmit, 6,755 mc receive.

PLANT CITY employee checks over the newly installed microwave equipment antenna site at that operational center

MAIN DISPATCH CENTER at Tampa directs and controls all Tampa Electric Co's operations throughout its 1,700 sq miles of service area. Microwave permits control of power flow, breaker and switch operation, etc, remotely



New Test Method Affords Dat

Procedure precisely measures voltage drop and phase shift in secondary leads of PT

THOMAS PENDRAY, Meter Engineer, Tennessee Valley Authority, Chattanooga, Tenn.
L. M. STANTON, Electrical Engineer, Electric Energy, Inc, Joppa, Ill.
C. B. WOOLLEY JR., Area Supervisor, Tennessee Valley Authority, Paducah, Ky.

A new test method precisely measures the effects of impedance drops in the secondary cables of potential transformers used in metering and develops data on voltage drops and phase shifts useful in correcting metering registration. It uses a second potential test set, a 1:1 PT, and a spare pair of unburdened leads. The spare leads are connected to afford a comparison of the magnitude and phase-angle relationships of the sending and receiving voltages on the instrument transformer's secondary leads.

Ideally, meters are installed as close as possible to transformers, the cables being large enough to carry burden currents without introducing intolerable errors. But such placement is not always practicable because of layout and difficulty in precalculating errors. Large errors may arise from the mere application of burden to the usual leads.

Conductors from CTs usually have the simple effect of adding burden, which affects their accuracy only minutely. But secondary conductors from PTs can insinuate appreciable errors which are independent of the instrument's accuracy characteristics. Such errors are associated with voltage drops and phase shifts caused by the impedance of long or heavily burdened secondary conductors.

Both these effects of the impedance drop produce a loss of registration under lagging power factor loads. The loss is greater for lower power factor burdens, such as, watthour meters.

Voltage drop and phase shift on a single-phase circuit can be calculated easily and accurately. But they are usually quite difficult to calculate in polyphase circuits where the PT secondaries are normally interconnected with a common return lead for all PTs. Current in the return lead is not in phase with that in the potential coil of the metering instrument, magnitude of the return current differing from the phase conductor currents.

Currents Cause Voltage Rise

For example, return current in two-element delta metering is much greater than in three-element wye metering. In the latter, the return current is zero when burdens are balanced. When burdens are unbalanced, however, the return conductor carries zero-sequence current, the phase position varying up to 360 deg in response to the amount of unbalance. In such an instance, the currents in a phase conductor and the return lead frequently cause a voltage rise at the terminal of one potential coil.

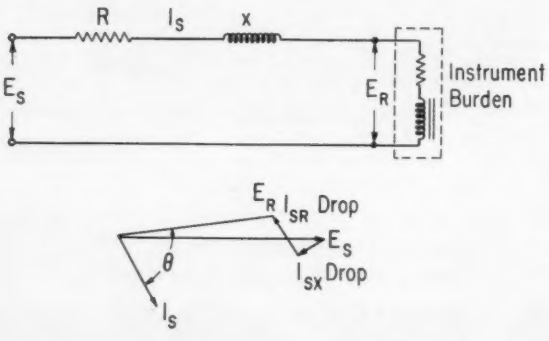
The new test uses a standard PT test set designed for comparing the magnitude and phase angles between secondary voltages from two like PTs. The voltage comparison at the end of two unburdened conductors is indicated on the ratio and phase-angle dials.

Unburdened conductors may be either spares in the potential cable or a separate pair extending from the PT to the metering instrument. Under test conditions the only burden on these leads is the transformer *S* component of the test set, which is so small that it causes only a negligible error. The PT test set must be equipped with a detector system having a very low capacitance to ground.

Special Test Required

Before testing a metering installation, a special test must be made because of the internal connections of the set. The secondaries of the two PTs have a common connection. Thus a 1:1 external PT is needed to isolate the unburdened conductors to measure the drop and phase shift in both secondary conductors. The accuracy of this PT must be established with the unburdened conductors and the test set connected.

For this preliminary test, connection is as shown in Fig 3. The ratio and phase-angle dial readings establish the accuracy. Then the final test is made at the metering instruments, with the connections as in Fig. 4. For both tests, the 1:1 PT should be as close as practicable to the secondary terminals of the main PTs. Usually, the connections to the potential coil can be



$$\text{Percent voltage drop} = 100\,\frac{I_S(R_S\cos\theta + X_S\sin\theta)}{E_S}$$

$$\text{Phase-shift angle } Y = \sin^{-1}\frac{I_S(R_S\sin\theta - X_S\cos\theta)}{E_S}$$

$$\text{Voltage-drop correction factor} = \frac{E_S}{E_R}$$

I_S = Current in secondary circuit
R_S = Resistance of secondary circuit
X_S = Reactance of secondary circuit
E_S = Sending end voltage
θ = Power factor angle of burden

FIG 1—IMPEDANCE DROP in secondary cables of potential transformer causes excessive loss of meter registration

Correcting Meter Registrations

made to the meter test block, which is close enough to the meter.

Both tests should be made for each set of leads connected to the potential coils of the meter. The unburdened leads are always connected to the standard terminals of the set, so that induced voltages do not affect the results.

Results of both tests are used to compute the correction factor. The ratio correction factor for the sending and receiving voltages is derived by dividing the percentage of ratio reading obtained from the Fig 4 test by that of the ratio reading obtained from the Fig 3 test. The phase angle between the voltages is obtained by algebraic subtraction of the phase angles measured in both tests. The sign of the measured phase angle is indicated on the phase-angle dial of the test set.

Excessive errors caused by conductors can be confined to acceptable limits or eliminated by the following methods, two of which use the new test procedure:

1. Replacement of the conductors with a size that reduces the error to acceptable limits.

2. Installation of static capacitors at the receiving end of the potential cable when the burden power factor is low and lagging, like that of a watthour meter. Capacitors can be selected to eliminate the reactive current so as to reduce voltage drop and the angle between sending and receiving voltages. Capacitors can also compensate for the combined phase-angle errors of the instrument transformers and cable. The effectiveness of capacitor compensation can be determined accurately by the test set. Remaining IR drop expressed as a percentage ratio can be compensated for by adjusting the meter.

3. Calculation of the final correction factor and the application of compensating adjustments to the watthour meters. This factor is computed by applying the cable errors derived by the test set to the formula for determining the final correction factor for the instrument transformers.

This formula then becomes:

$$FCF = RCF_{CT} \times RCF_{PT} \times RCF_{C} \times \frac{\cos[\theta_2 \pm (\pm A \pm B \pm Y)]}{\cos \theta_2}$$

Where:

FCF = Final correction factor

RCF_{CT} = CT ratio correction factor

RCF_{PT} = PT ratio correction factor

RCF_{C} = Potential cable ratio correction factor

θ_2 = Apparent power factor angle, determined from secondary currents and voltages

A = CT phase-angle error, which is "positive" when the secondary current leads the primary current

B = PT phase-angle error, which is "positive" when the secondary voltage lags the primary voltage

Y = Potential cable phase-angle error, which is "positive" when the voltage at the meter terminals lags the voltage at the potential transformer secondary terminals

A plus sign is used before the parenthesis for lagging power factor loads.

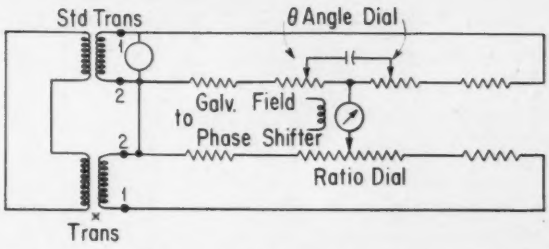


FIG 2—TEST SET is used to compare magnitude and phase shift of sending and receiving voltages on potential cable

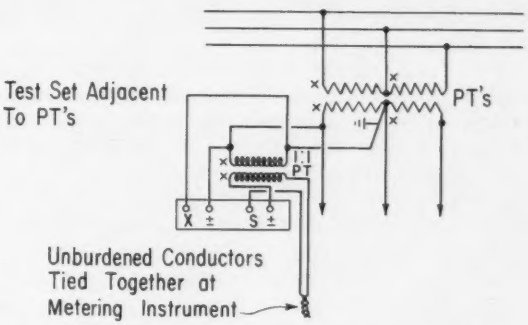


FIG 3—SPECIAL TEST circuit is necessary to establish accuracy of 1:1 PT connected with unburdened conductors

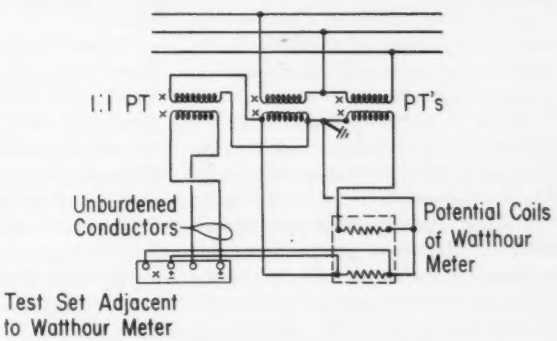


FIG 4—STANDARD TEST circuit is set up with test set placed as near as possible to metering instrument

Example of Test Data and Interpretation

Test	RCF Dial	Phase-Angle Dial
1:1 PT Test	100.23	−4 min
Metering Test	100.56	+16 min
	100.33	+20 min

These data approximate the result obtained on a 120-v single-phase secondary circuit of No. 10 AWG copper conductors, 400 ft long, supplying a burden of 100-va at 50% pf. The correction factor for these cable errors will be 1.0033 for loads at unity pf, 1.0064 for loads at 86.6%, pf and 1.0133 for loads at 50% pf.

Urges Broader Power for PUD's

Former REA officer tells CMUA commissions should control companies' debt ratio as step in wielding even further authority

C. A. WINDER, rate consultant, tells California meeting regulatory bodies should extend utility rates control

C. A. Winder, consultant to the Federal Power Commission and one-time REA chief of operations, declared recently before the California Municipal Utility Association that public utility commissions should control the debt ratios of private utility companies.

Such ratios exert great leverage in rate control, he told the group's Feb. 25-27 annual meeting at Berkeley, Calif.

This assumption of authority by the regulatory bodies, Winder argued, could constitute the longest single step toward controlling utility costs and rates and could lead to even further controls.

Even if a commission won't assume authority to set debt ratios, it should base its rate-making rules on the assumption that debt ratios are kept above certain minimums, said Winder, now a Pasadena rate consultant and representative of the CMUA in rate matters before the California PUC. He flouted as "unproved" the contention that increasing debt ratios could jeopardize private company financial stability. The goods of manufacturers, who must buy private power, are priced to reflect the rates of the private companies, he asserted.

The portion of residential rates attributable to operating expenses afford a yardstick for comparing the rates of public and private utility neighbors, declared A. H. Driscoll. He is Los Angeles Assistant City Attorney. This figure, he said, is obtained by multiplying residential rate average by the utility's operating ratio.

In California, for example, private power average residential rate is 2.89¢ per kwhr and operating ratio 43.4%, so that operating expense is 1.154¢ per kwhr. By comparison, public power, he said, runs 2.08¢ and 56.2%, reflecting 1.168¢ per kwhr operating expense. Actually, additional adjustments for free services to communities by publicly owned utilities, must be made, Driscoll added. But rate comparisons are only one yardstick, he said, as adequate maintenance and service must be provided to keep the municipal in business.

Federal income tax boosts proposed for insurance companies could return them to the tax-exempt municipal bond market from which they've long been absent, said A. K. Browne, Bank of America. The salutary effect on the market might be balanced, however, by a potential downgrading of state securities caused by financial difficulties recently encountered by several large states. This downgrading could have an unwelcome cross-effect on municipal securities, he told CMUA delegates.

Bills in the California legislature bent for placing publicly owned utilities under jurisdiction of the Public Utility Commission and for levying privilege taxes on formerly tax-exempt properties of public agencies, were noted in CMUA resolutions.

The association board approved resolutions favoring federal development of power features of the Trinity River Project and state-level studies of the Pacific Northwest-California Power Intertie. New officers elected were Robert Brusatori, Marin Municipal Water District, president; Ralph Foy, City of Burbank, vice president; F. V. Frey, Pasadena, secretary; and Glenn Baxter, Alameda, treasurer.

Load Control Is PEA Topic

Automatic control has caused occasional uneconomic loading on West Penn Electric Co's 1,691-Mw system, C. W. Ross told the Pennsylvania Electric Association's Prime Movers Committee at Pittsburgh.

This uneconomic loading occurs, he said, primarily because controlled newer units must operate normally below their maximum capabilities, reserving operating range to compensate for the slower response of older, stoker-fired units.

The system, he went on, has four major ties to neighboring utilities and can control 24 Mw per 0.1 cps to convert frequency swings in the interconnected system and hold total tie-line flows within 30 Mw at peak and 5 Mw during light-load periods. The tie-line, frequency-bias control regulates about 1,000 Mw of generation, he added.

Operation of West Penn's new 165-Mw unit at Armstrong Station revealed the need for controlling ambient temperature on such items as lubricating oil for pulverizers, and the electronic coal weigher, reported D. E. Gervenak.

Conveyors Speed Mixing, Cut Production Costs

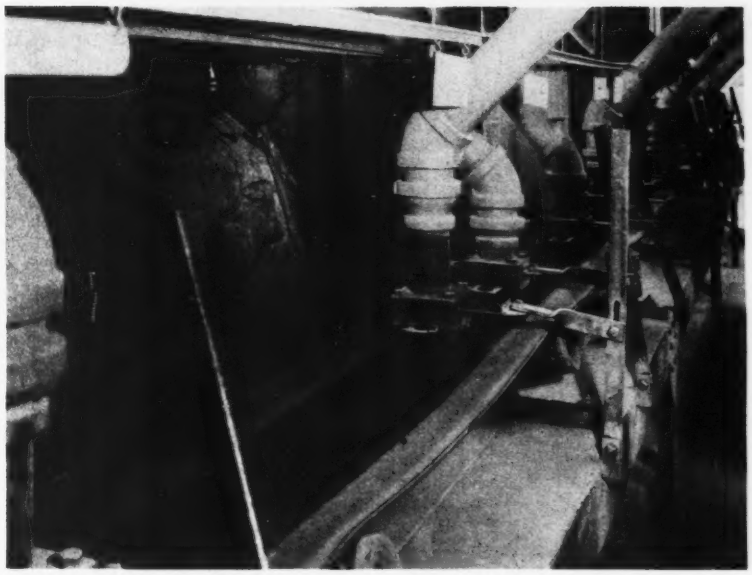
V. R. EVANS, Industrial Power Representative, Baltimore Gas & Electric Co., Baltimore, Md.

A switch to automatic handling and mixing of granular mineral used in surfacing roofing materials has speeded up operations and produced considerable savings in manhours at the Ruberoid Co., Baltimore, Md. The fully automatic system uses seven conveyors, totalling 30 hp., to move the material from the incoming rail cars to storage, then mix it and feed it to the point of application. Volumetric and other types of switches at strategic points start and stop the electrified handling equipment to ensure continuous delivery.

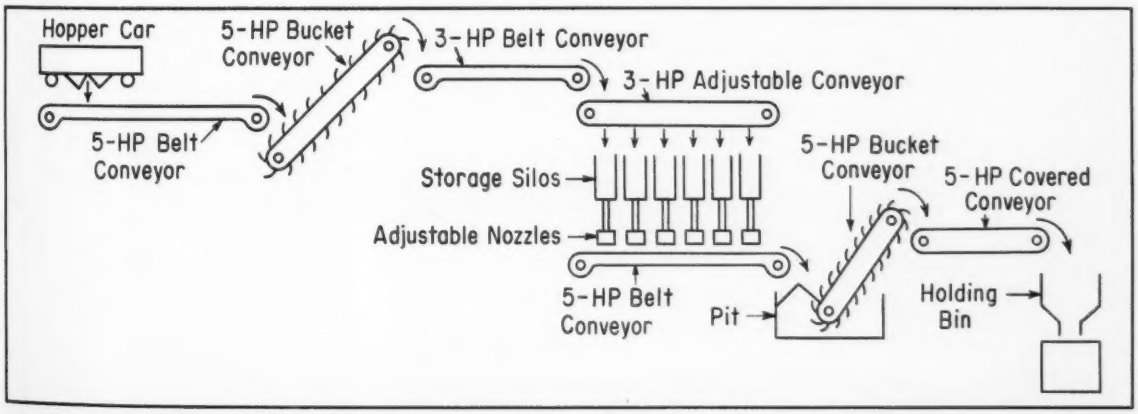
The material is received in a number of standard colors which are then blended to produce a range of color blends from which the customer can choose. Formerly the material was delivered to the plant in box cars and unloaded by hand — a slow difficult task that required two men. Batching and mixing the various colored minerals according to formula were just as onerous.

Granules now arrive in covered railroad hopper cars that discharge their contents in a steady stream to a belt conveyor. This feeds a bucket conveyor that carries the material to the top of twelve storage silos. Here, the granules are transferred first to a fixed belt conveyor and then to an adjustable conveyor which can discharge into any of the silos.

The electric handling system also mixes the colored granules coming from the silos and blends them thoroughly while carrying them to the point of use. Intentional rough handling — pouring and agitating at conveyor transfer points — eliminates the need for special mixing equipment.

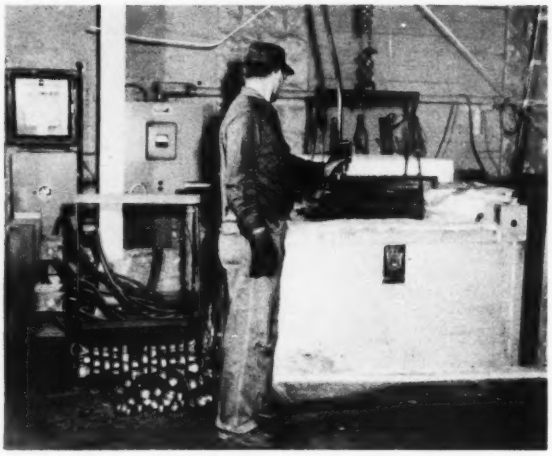


AUTOMATIC PROPORTIONING of material from twelve storage silos assures proper color in finished product. Ingredients are blended at conveyor transfer points



COMPLETELY AUTOMATIC materials handling and mixing system carries raw materials from incoming rail car, through storage and mixing, to final point of use. Replacing a costly, tedious manual mixing system, it uses approximately 30 hp.

Electric Salt Bath Key To Quality Heat Treating



RALPH O. SMITH, Industrial Sales Engineer, Connecticut Power & Light Co., Meriden, Conn.

Quick heat recovery, inherently good atmosphere control, and fast even heat-up of the material are the big advantages of two electrically heated salt bath furnaces used to heat treat steel forgings for aircraft at Consolidated Industries, Inc., Cheshire, Conn. Because of their ultimate use, the forgings must meet rigid specifications and require accurately controlled processing.

Work is processed at temperatures ranging from 1,000F to 1,500F. Each furnace has four water-cooled electrodes to carry the current directly through the salt solution. Furnaces are rated about 65 kw.

Direct heating of the solution assures the quick heat recovery. Constant flow of the solution around the parts provides the uniform heat-up.

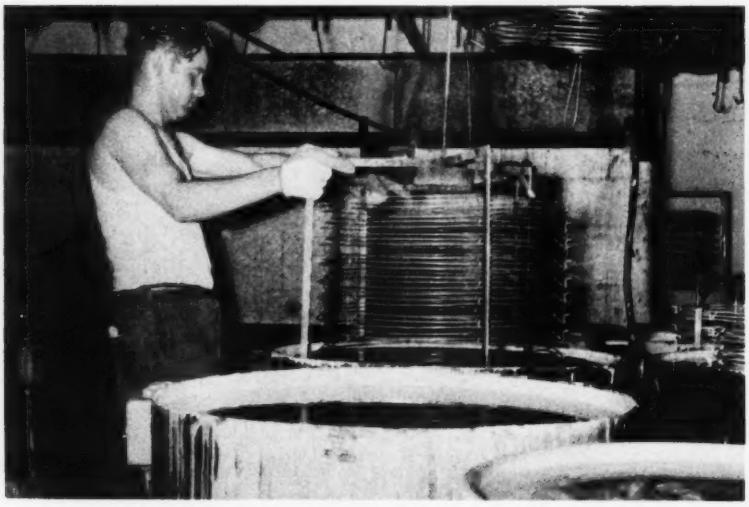
Electricity Plays Big Part In Plastic Coating

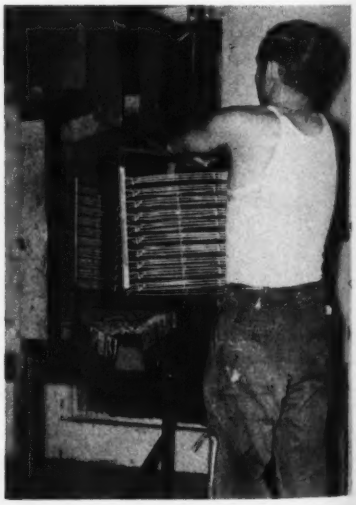
JAMES R. WARK, Power Sales Engineer, Indianapolis Power & Light Co., Indianapolis, Ind.

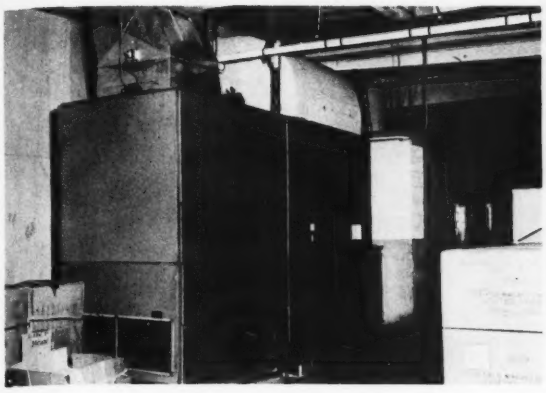
Electric power and heat play a big part in the production of plastisol coated conveyor racks and plating racks at Niehaus Brothers Inc., in Indianapolis. Niehaus, one of the leaders in this relatively new field, uses electric heat, electric conveyors, and electric cleaning in their highly mechanized production system. In addition to providing insulation and corrosion resistance, the plastisol coatings prevent damage to manufactured parts carried on conveyors.

After electrocleaning and phosphatizing, the metal parts are dipped in a primer solution and then air dried for six minutes at 385F in an electric conveyor oven. The parts are cooled and then dipped into the plastisol at room temperature. Controlled time withdrawal lifts the parts out of the plastisol at a predetermined rate. They are then conveyed to an infra-red oven and baked.

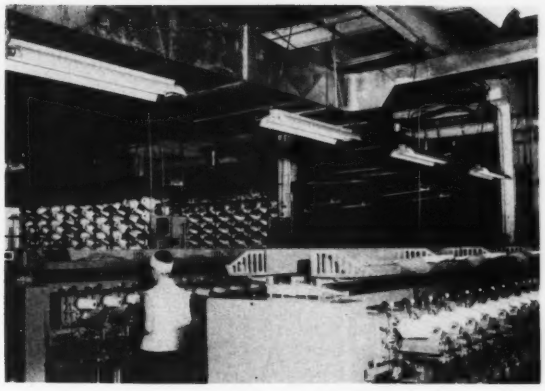
The baking cycle can be controlled by varying the amount of heat applied, the conveyor speed, and the flow of exhaust air. Each side of the oven has four, 4-ft., quartz infra-red panels. The combined units total 254 575-watt heaters. Each section of the oven has an individual control.







With 50-ton air conditioner . . .



providing steady 75F temperature . . .

Maintenance, Absenteeism Drop In Textile Plant

L. ALBERTSON, SUPERVISOR, Sales Application Dept., Philadelphia Electric Co., Philadelphia, Pa.

Modern air conditioning is paying big dividends in reduced maintenance, a smoother operation, and less absenteeism at the Textured Yarn Co., a Philadelphia firm engaged in modifying filament yarns.

Now, fewer machine adjustments are required because the yarn condition is kept uniform. The constant year-round temperature extends machinery life by preventing excessive expansion and contraction of parts. With improved working conditions, time is saved on machine repairs. Increased comfort has reduced absenteeism on summer days. Moreover, the company attracts better, more skillful workers.

One 50-ton unit is used in the twisting and winding department. A 40-ton unit cools the rest of the plant and the office. Carefully planned ducts keep the temperature at 75F in the area where machines twist yarns at 70 yards per minute and wind at 175 yards per minute.

Strapping Machine Ups Output From 25 To 300

Twelve times as much output with no increase in man-hours — that's the pay-off from a new semi-automatic strapping machine used to unitize packages of coiled copper tubing at the Reading Tube Co., Reading, Pa. Now, one man can stack and strap 300 units per shift, compared to 25 per shift when the work was done manually.

The pushbutton machine applies two steel straps, with uniform tension, then cuts and joins the strap ends permanently with two spot welds. Strap waste is avoided because the end of one tie is the start of another. The strapped units are then loaded on a skid and removed from the area by lift truck.

What's Your Production Problem?

If you have problems in lighting, drying, casting, forging, painting, or materials handling, consult your local power company. Let their experienced specialists show you how to cut costs with electric power.

Heat Pumps Boost Employee Efficiency, Morale

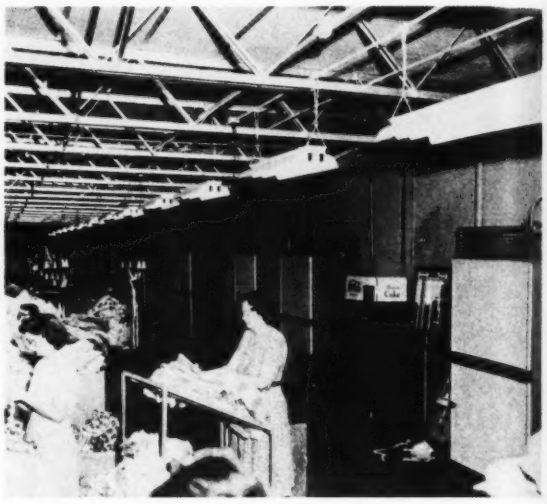
"My employees are more efficient and happy since we installed Weathertron heat pumps for heating and cooling in our new plant. I am very well pleased with their operation," said Mr. L. L. Moore, president of the Toll Gate Garment Co., Inc. This Hamilton, Ala. company produces 6,000 sports shirts daily in a 22,000 sq. ft. building, constructed in 1957 after the former building burned.

For this new plant, all types of heating and cooling were investigated, taking into consideration the advantages of heating without burning fuel; cooling without using water; installation without the use of ducts; automatic heating and cooling during the summer, winter, and in-between seasons without resetting the thermostat; operating costs; and the advantage of filtered air in the plant.

The heat pump met all these requirements. Thirteen heat pumps were obtained. They are installed adjacent to the outside wall. The intake and discharge of air is through wall openings covered with grills. Each unit is thermostatically controlled to provide the proper temperature during all seasons of the year. No ducts are required except for the offices in the front of the building.

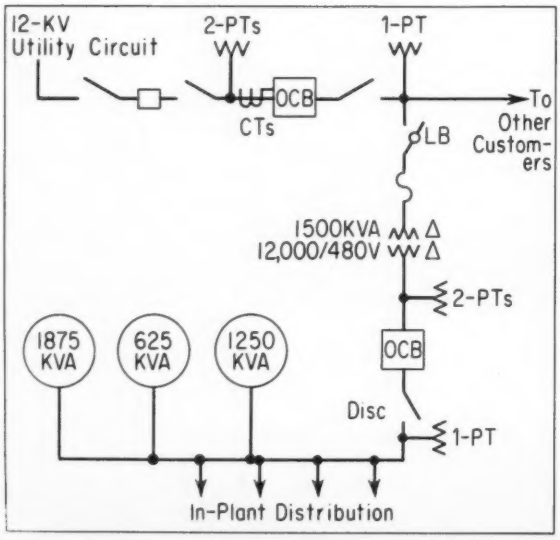
In addition to comfort cooling and heating the new plant has adequate illumination. Fluorescent lights provide 50 foot-candles of soft light on the work surface. For close work, individual lights installed on the machines supplement the general lighting.

Due to the very pleasant working conditions, Mr. Moore said that there is a very small turnover in the company's 180 employees.



Although the new plant has been in operation for only a few months, indications are that the power cost for production and year 'round air conditioning will be slightly less than the estimate. Alabama Power Co. estimated that the power cost for year 'round air conditioning will be only 4.6 cents per employee per work day – a small amount considering the personal and production benefits that result.

Operation More Economical With Utility Tie



EDWARD F. SPEAR, Industrial Engineer, Delaware Power & Light Co., Wilmington, Del.

Parallel power operation between their own private generation and a utility supply is paying off in more economical operation, a better steam balance, and a firm source of standby power for the National Vulcanized Fibre Co.'s Yorklyn, Del. plant.

Before the tie was made, National generated all its own power from steam, which was also used for heating and processing. As production increased, more steam was needed for generation than for heating and processing. The dual use of steam then became uneconomical when condensing was required.

Automatic control equipment regulates the "Infeed" of power from the utility and the National's generation for the most economical operation. Although large generating capacity ratios exist, safety devices sense the direction of current flow and protect both the plant equipment and utility lines against malfunctioning of the parallel system.

Point System Determines Substation Oil Plant

Type and extent of insulating oil facilities provided for Bonneville Power Administration substations are determined by a unique rating system set forth in BPA's substation design standards.

A substation qualifies for one of three classes of oil system in accordance with its "point rating." Points are awarded the station for each oil circuit breaker and power transformer it has initially, plus those it is expected to add the first five years.

The three classes and the points for each, are:

- Class A, 75 points or more
  Oil house, storage tanks, transfer and filtering pipes and valves, provisions for recirculation within any one tank, yard distribution system
- Class B, 36 to 74 points
  Storage tank(s), yard distribution system, but no oil house
- Class C, 18 to 35 points plus any station less than 18 where the largest OCB has total 3-pole capacity over 4,000 gal
  Storage tank(s), but no oil house or yard distribution system
- Any station totalling less than 18 points (except as noted above) does not qualify for an oil system

The Class A distribution system provides permanent connections to each equipment, while the Class B system places risers and hose valves within 30 ft of the equipment, with hoses making temporary connections as needed.

Points are assigned as follows:

230-kv dead-tank OCB—9 points per 3-pole unit

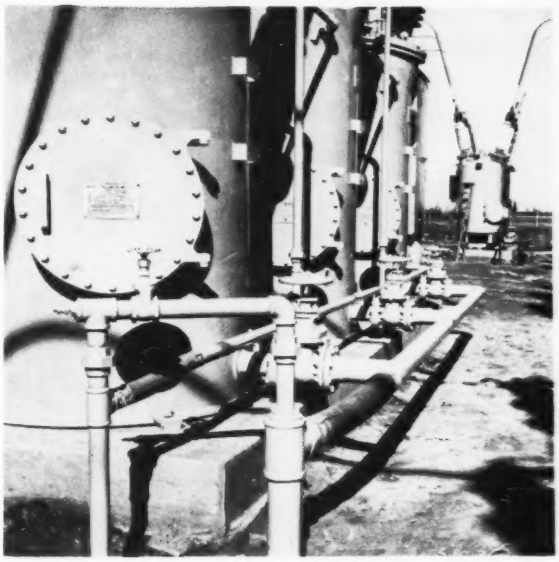
115-kv dead-tank OCB—6 points per 3-pole unit

69-kv dead-tank OCB—3 points per 3-pole unit

34.5-kv dead-tank OCB—2 points per 3-pole unit

15-kv dead-tank OCB—1 point per 3-pole unit

Transformer, 20 MVA or larger—2 points per 3-ϕ tank



CLASS A insulating oil distribution system brings permanent connections to oil circuit breaker tanks

Transformer, less than 20 Mva—1 point per 3-ϕ or 1-ϕ tank

Transformers are credited on self-cooled rating, except all-forced-cooled transformers.

Storage facilities consist of 10,000-gal tanks, in units of 1, 2, 4 or 6, as follows:

- Substation with "central shop" services—6 tanks
- Class A substation with maintenance district hq—4 tanks
- Other Class A or Class B substations—capacity equal to largest single equipment unit, plus one tank
- Class C substation—capacity equal to largest single equipment unit. Usual single-tank installation has equal compartments for clean and dirty oil

Acid Cleaning Preserves Brass Fittings

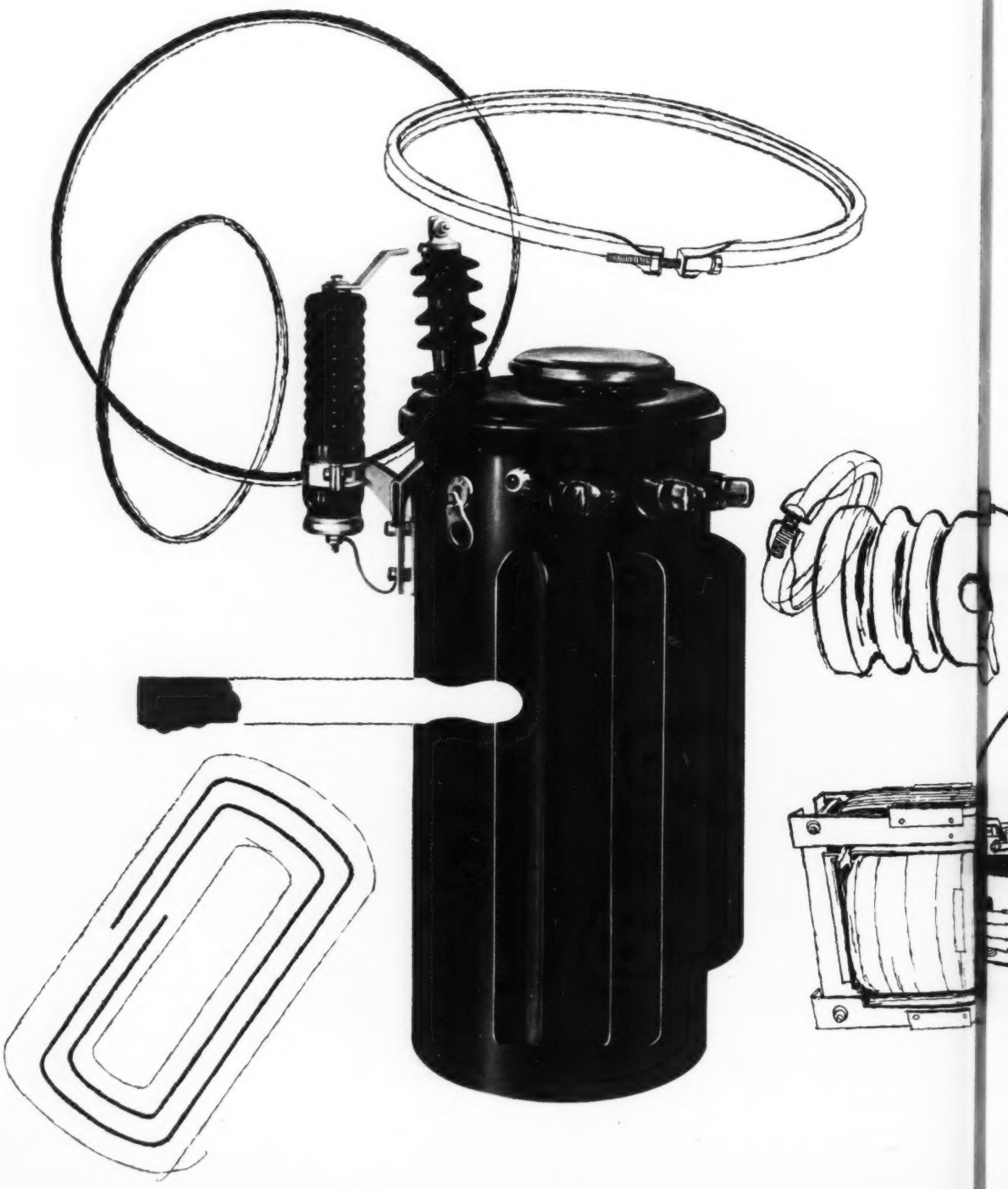
Brass fittings are being cleaned by Central Power & Light Co by soaking them in a mild acid detergent solution. The solution, known as "Tart," is mixed with an equal amount of water in a plastic container. Fittings are placed in a plastic basket with a copper handle and lowered into the solution where they are allowed to soak for an hour.

After soaking for an hour the basket of fittings is lifted out and rinsed with clear water. After drying, fittings are dipped in a light oil to prevent corrosion.

The cleaning operation is carried out in each of CP&L's seven district storerooms. It is estimated that the program has saved thousands of dollars worth of fittings.

(*More Methods on page* 54)

Before you buy another



he transformer... **COMPARE FEATURES**

General Electric—alone—offers <u>all</u> these exclusives which add up to reliability, long life, less maintenance for you

General Electric innovates to earn your orders. So compare these features with competitive features to determine your best transformer buy.

Be sure to compare *all* features. You'll see that only General Electric offers *all* these exclusives: Formex* wire; AL/CU terminals; strenicor clamps; stainless-steel bands and nitrile rubber gaskets; valve-type arresters—so that the sum of individual features adds up to greater value in long, reliable life.

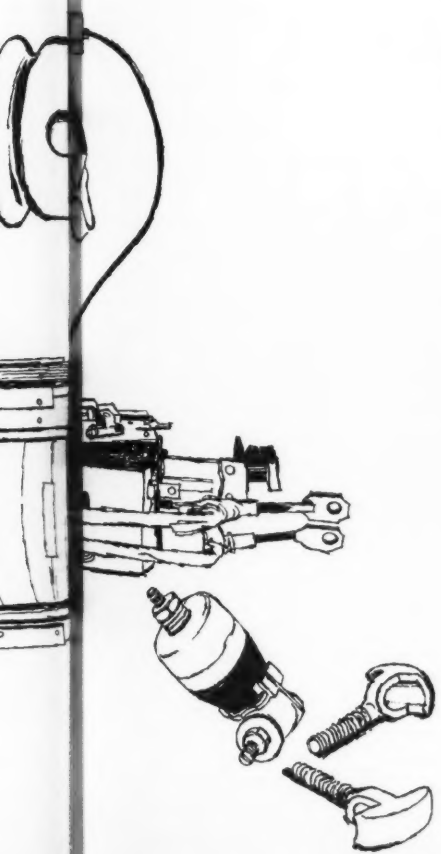
Before you buy another distribution transformer, compare features—give your transformer manufacturer credit for the extra values he gives you. General Electric Co., Schenectady 5, N. Y.

431-81

* Reg. trademark of G.E. Company.

Progress Is Our Most Important Product

GENERAL ELECTRIC

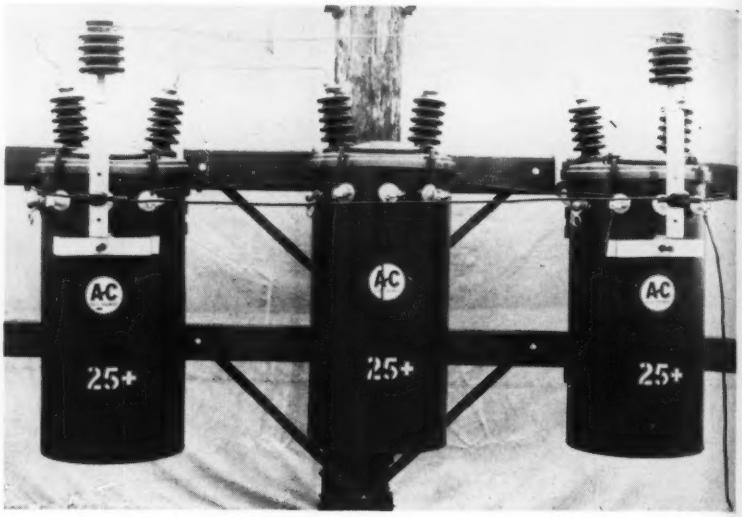


GIVE YOUR TRANSFORMER MANUFACTURER CREDIT FOR THE EXTRA VALUES HE GIVES YOU		G.E.	OTHER MFRS.			
MEASURE LOAD BUILDING—do Co.'s other products build load? Does Co. sponsor load-building programs?						
CHECK SERVICE—24-hour shipment? repair and uprating? emergency assistance?						
COMPARE FEATURES—how many exclusive features in terms of longer life; reliability; easy maintenance?						
ANALYZE PRICE—does Co. hold line against inflation with significant product developments?						
EVALUATE INNOVATIONS—has Co.'s research paid off for you? Recent examples?						

FILL IN THE BLANKS . . . See which manufacturer gives you more for your transformer dollar: Mark "X" for a measurable contribution, "O" for insignificant contribution.

Transformer Bracket Supports Delta Connections

J. O. HARRIS, JR, Distribution Engineer,
J. J. LOMBARD, Distribution Engineer,
Southern California Edison Co, Los Angeles, Cal.



A new transformer lead bracket makes possible a safer and more economical delta - connection method on 3-phase transformer banks using pole-type self-protected distribution transformers.

The bracket, thoroughly tested and subjected to field trial installations, supports both high and low-voltage leads. One bracket, equipped with standoff insulators, is installed on each of the outside transformers mounted in line on a conventional hanger arm.

No special mounting equipment is needed. The bracket bolts to the NEMA standard ground lug below the low voltage bushings and extends up and away from the transformer case.

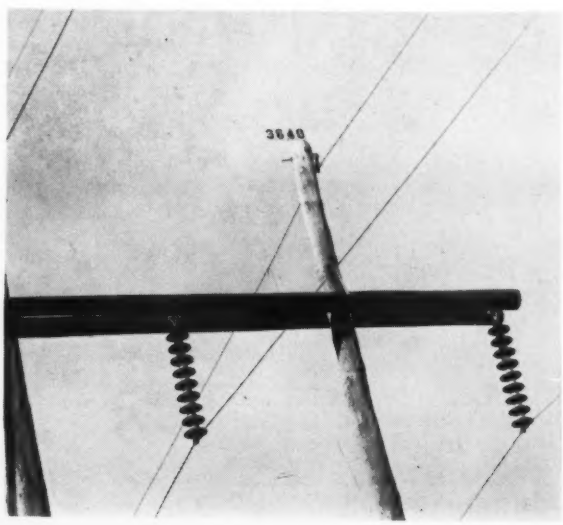
Use of the bracket keeps high voltage leads on the transformer side of the pole, out of the normal climbing and work space. The bus conductor closing the high voltage delta is supported by the standoff insulator atop the bracket, so the usual bus-support arm is eliminated. The transformer hanger arm can thus be placed in the position formerly occupied by the bus-support arm, saving 30 in. of pole space.

The low voltage leads are supported by standoff insulators attached to the bracket front.

The brackets are fabricated of galvanized hot-rolled flat steel by several pole-line hardware suppliers. Normally, they are attached to the transformers in the field.

These brackets are being installed on self-protected transformers on the 12 and 16-kv distribution systems of Southern California Edison Co with complete satisfaction.

Enamel Signs Aid in Tower Identification



D. V. GREEN, Transmission and Distribution Superintendent,
A. A. CHASE, Conversion Engineer, Connecticut Light and Power Co, Berlin, Conn.

Porcelain enamel signs mounted at the top of transmission poles and towers enable Connecticut Light and Power helicopter patrols to identify structures quickly and accurately. Signs are used on each structure whose number ends in zero or five and on the first and last tower in each line.

Signs are installed on each face of the structure to enable the patrol to identify the structure when approaching from either direction. On wood poles, a set of digits is installed on each side of a single bracket. Two brackets are used on most steel transmission towers.

Number digits are on individual steel plates, 6 in. high x 5 in. wide, with grommets centered top and bottom. The figure is 5 in. high, black on a yellow background, all baked porcelain enamel.

Daystrom to Make 'Little Gypsy' Automatic

First completely automatic steam power plant with digital computer control system to be on Louisiana Power's line

A unique electronic computer control system that will make Louisiana Power & Light Co's Little Gypsy generating station the first completely automatic steam power plant is being designed and built by Daystrom Systems, a division of Daystrom, Inc. Contract for the automatic control system that will start up, operate, and shut down the 225-Mw single-unit station without human intervention was awarded the La Jolla, Cal., firm by Ebasco Services, consulting engineers for the Louisiana utility. Estimated cost of the automatic control system is $750,000.

The electronic control system for Little Gypsy will incorporate a solid-state, general-purpose digital computer and will benefit from experience gained at Louisiana Power & Light Co's Sterlington Station where a Daystrom solid-state operational information system has been in successful service for about one year. It is estimated that Little Gypsy, for fully-automatic operation, will cost only 2½% more than with semi-automatic operation.

At Little Gypsy the control loop has been closed. Unlike Sterlington, the all-important additional function of control has been assigned to a computer which will control start-up and shutdown of the station. Start-up will take 4½ hours compared with a probable minimum of 6 hours for conventional manual control, a factor expected to permit more frequent plant shutdown, if desired. The plant will go off the line immediately upon pushing the shutdown button.

About 700 points of inspection or actuation are involved in starting a station of the size of Little Gypsy. The computer will scan and verify all on-off points and position indicators between each of some 800 total steps involved in starting and stopping the plant. All procedures for hot or cold start-up, for complete or temporary shutdown and banking the boiler will be automatic.

When the station is on the line the computer automatically re-programs itself and goes into operational mode. It will run the plant operating four major control loops; combustion control, steam-temperature control, feedwater control, and spray control. The latter is an overriding steam temperature control, a safety feature.

Also included is a fuel safety and purge system that instantly shuts off gas and purges the boiler with air upon indication of an explosive mixture in the boiler.

The computer is to be in continual contact, via microwave link, with the main LP&L dispatching station in Pine Bluff, Ark., receiving signals to increase or decrease station output. Within 1 second of receiving such a command, proper action is taken simultaneously on all operating loops.

Should malfunction occur, and the generator get out of phase, the computer immediately removes it from the line. It has been estimated that the computer can detect such a dangerous situation in 2/5 sec compared with 11 to 15 sec for a good human operator.

Because of this faster reaction and greater sensitivity it is predicted that Little Gypsy can be run more safely and much closer to actual equipment operating limits. However, should the computer find itself confused it automatically "resigns" and turns the plant over to the human operator in semi-automatic operation with appropriate visual and audible signals. For safety and maintenance Little Gypsy will use three men at all times—the normal complement of attendents for a station of its size.

In addition to the functions of plant control, the computer does all computations on component efficiencies and overall efficiency and measures important points of the system. All such data is automatically logged. However, although the computer takes less than one second to do the calculations, five minutes are required to log the data because of the mechanical lag of the typewriter. A log sheet can be printed on demand by the operator at any time. Special display of plant efficiency is also provided by the computer, which compares Btu input with Kw output.

Digital Computer to Direct Load Control

Philadelphia Electric and Honeywell plan joint development of first automatic economic dispatch system of this type

Philadelphia Electric Co and Minneapolis-Honeywell Regulator Co will collaborate in the development and operation of the first digital—computer—directed system aimed at obtaining more efficient control of power generation at minimum cost.

The computer-directed control system, scheduled for operation by the end of 1960, is designed to:

1. Calculate the least expensive pattern of allocating generation to meet system demands.

2. Automatically assign this allocation to generating units.

3. Provide cost data for billing computation on the power exchanged with neighboring utilities.

The digital computer, called the D-290 and developed by Honeywell's Datamatic Division in Boston, is a transistorized high-speed

(*Continued on page* 59)

THE MAN WHO HAS TO KNOW . . .
GEORGE K. KALLENBACH, OPERATING SUPERINTENDENT,
EASTERN DIVISION, TELLS WHY . . .

RESEARCH pays dividends for Niagara Mohawk's investment in General Electric voltage regulators

"To minimize reactive currents on a 33 kv loop, we were seeking the optimum setting for the line-drop compensator on our regulators. A General Electric system research study gave the answer; verified it on a network analyzer set-up of our system."

General Electric regulator research means not only such system studies but also continuing product innovation. You get dividends in these exclusive features: controlled-speed, Opti-life switching mechanism; electrostatic shielding to prevent flashover due to carbon accumulation; and exclusive Thyrite* by-pass resistors for internal series winding protection.

* Registered trademark of General Electric Co.

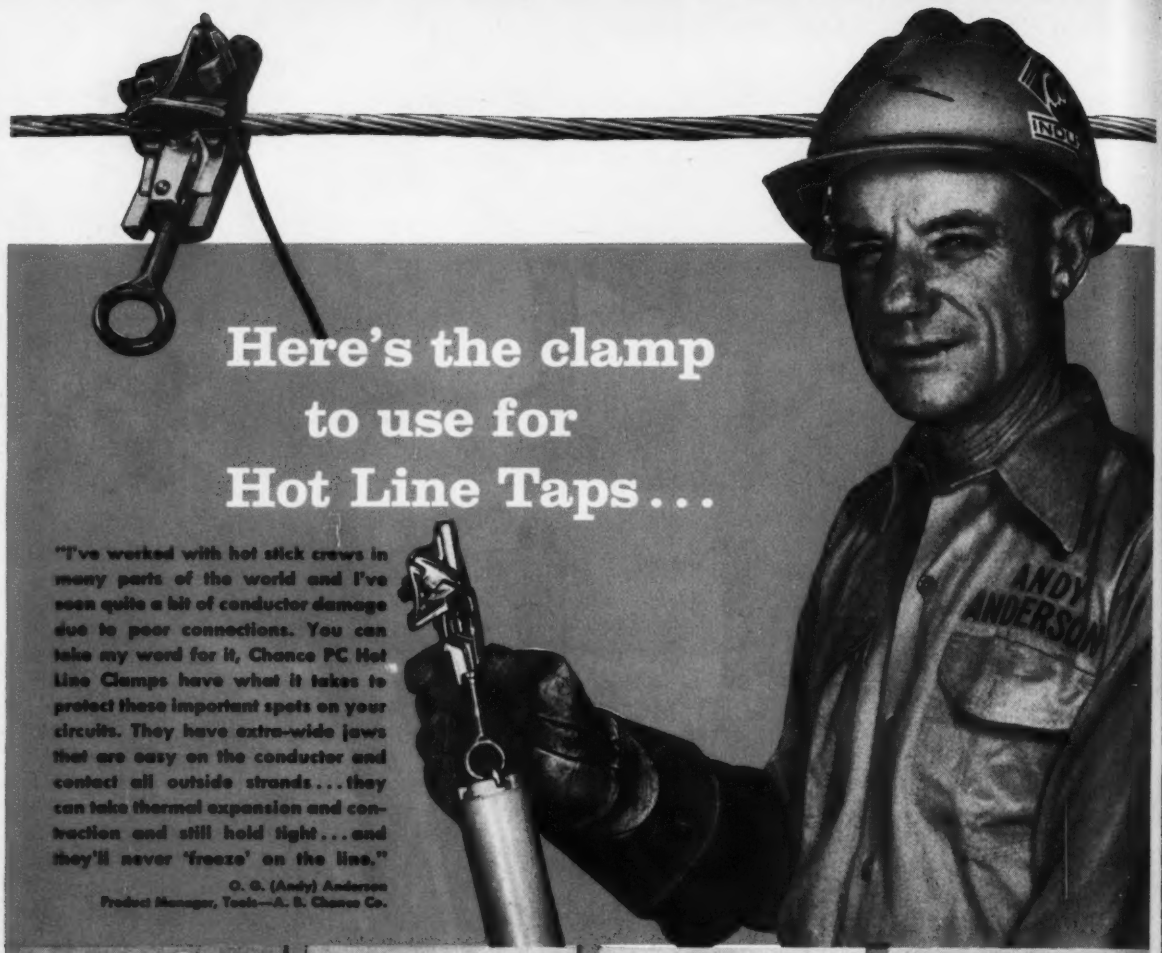
Through continuous research, the cost of regulation with General Electric regulators has remained essentially the same for 28 years.

GENERAL ELECTRIC REGULATORS COST LESS ON THE LINE because you get continuing extra dividends . . . from **G-E RESEARCH** — superior regulating equipment; from **G-E DEPENDABILITY** —absolute minimum maintenance; in **G-E SERVICE**—routine or emergency. Result: Extra Values = **EXTRA PROFIT.**

Only General Electric returns so much for your regulator investment. Ask your G-E regulator representative to show you how. General Electric Company, Schenectady 5, New York. 423-37

Progress Is Our Most Important Product

GENERAL ELECTRIC


Here's the clamp
to use for
Hot Line Taps...
"I've worked with hot stick crews in many parts of the world and I've seen quite a bit of conductor damage due to poor connections. You can take my word for it, Chance PC Hot Line Clamps have what it takes to protect these important spots on your circuits. They have extra-wide jaws that are easy on the conductor and contact all outside strands... they can take thermal expansion and contraction and still hold tight... and they'll never 'freeze' on the line."
O. O. (Andy) Anderson
Product Manager, Tools—A. B. Chance Co.
ANDY
ANDERSON
1
2
3
4

...and here's the way to get a lineman's cooperation in making trouble-free connections

Make it as easy as possible to apply clamps with **z.l.n. 100** by buying Chance clamps packaged with this *Contact Aid* pre-applied. Our engineering research and our experience with many utilities has taught us that Chance **z.l.n. 100** *Electrical Contact Aid* and a wire brush are the first requirements in making a long-lasting hot line tap. 1. Apply **z.l.n. 100** *Contact Aid* to the conductor cleaning brush. 2. Wire brush the contact area of the conductor to remove surface oxides and to apply the corrosion inhibiting *Contact Aid*. 3. Remove the plastic package from a Chance "Protected Connection" Clamp—(the *Contact Aid* is pre-applied to a factory-clean clamp). 4. Install the clamp—It's specially engineered for hot line taps that will let you give your customers continuous electrical service without danger of burn-downs and allow you to easily remove the service if necessary.

Chance "Protected Connection" Type PC Clamps are available in a complete range of sizes that can take from No. 6 ACSR to 1,431 MCM ACSR and comparable sizes of copper conductor. There's a type for every contact combination—including the Chance AGP with heavy fortified cadmium coating for additional protection on bimetal connections.

ABC INDUSTRIES

A. B. CHANCE COMPANY General Offices CENTRALIA, MISSOURI

CC59-4

Digital Computer to Direct Load Control

(*Continued from page 55*)

device. It employs digital techniques used in Datamatic's large business computers and modified for industrial use.

The proposed computer-directed system will include load frequency control equipment that carries out commands to load generators on the most economical basis, and peripheral equipment to link the two and enable the computer to talk to analog devices.

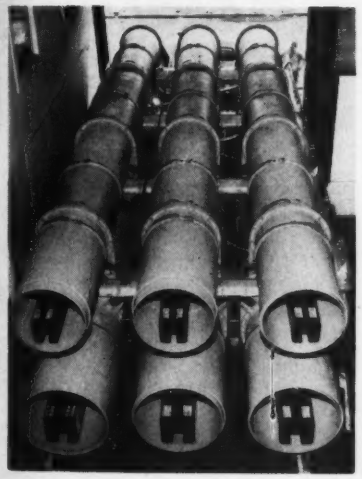
Primarily, the system will determine the economic allocation to Philadelphia Electric's generators of the total power assigned by the Pennsylvania-New Jersey-Maryland Interconnection. Such factors as transmission line losses and production costs for each generator will be considered.

The computer's digitized computations will be converted to analog signals and telemetered as commands to load control devices at the generating stations. There the commands will be apportioned among generators to produce the assigned power at the correct computed cost.

As a secondary function, the computer will determine basic interconnection cost data for accounting purposes on power exchanged over tie lines with five neighboring utilities. These are Pennsylvania Power & Light Co, Baltimore Gas & Electric Co, Delaware Power & Light Co, Public Service Electric & Gas, and Atlantic City Electric.

Information showing power flow in either direction will be received from tie line connections as analog signals. The computer will convert this data to digital form, integrate the flow, make a cost determination from information previously programmed into it, and punch out its computations on paper tape for further processing.

Aluminum, Double-Deck Buses Used



This double-decker, all-aluminum section of generator bus assembly is being installed by Commonwealth Edison. Delta-Star Electric Div, H. K. Porter, is shipping three similar units to the utility. Sections are 3-phase, about 30 ft long, 10 ft wide, 6 ft high, with ducts 30 inches in diameter and 11-inch-sq buses. Each is rated 8,000 amp at bottom, 6,000 at top. Aluminum supporting beams encased between 2 duct layers are suspended by vertical supports from the ceiling. The sections are pre-assembled. Delta-Star says these are probably the largest, most complete isolated-phase bus assemblies ever shipped.

MANUFACTURERS BRIEFS

Westinghouse will expand its line of pole-type distribution transformers to include 333-kva. Core-and-coil design used in conjunction with basic principals of smaller transformers will keep weight down to 2,100 lb. Tank height will be only 42 inches. New Athens, Ga., plant will produce transformers.

Bentley, Harris Mfg Co will introduce a new silicone-rubber coated fiberglass sleeving for high-tempera-

(*Continued on page 62*)

CUSTOM

Answers to operating problems:

SYSTEM GROWTH

PROBLEM: On many systems where manual dispatching is still used, the increasing complexity of loading problems will shortly require some form of automatic execution, although a comprehensive computer-control may not be needed for several years. Operators on these systems ask how they can get automatic generation control which is simple to operate, and thereby enable personnel to make the transition to automatic operation smoothly.

SOLUTION: Installation of an L&N custom control designed specifically for the particular operating problem at hand. A wide range of proved L&N control components makes it possible to select the control approach that provides an optimum combination of operating simplicity, minimum generation changes, and lowest costs at the coal pile.

Another advantage: You can add a computer to your control at any future time without obsoleting installed equipment.

Study the complete story and you'll see why more than 70 utilities—and some 60,000,000 KW—operate with L&N custom controls. Contact your nearby L&N Field Office, or 4938 Stenton Ave., Philadelphia 44, Pa.

LEEDS & NORTHRUP
Instruments Automatic Controls • Furnaces

.....if you use

Eliminate costly time-wasting, dangerous step

with the de externally op

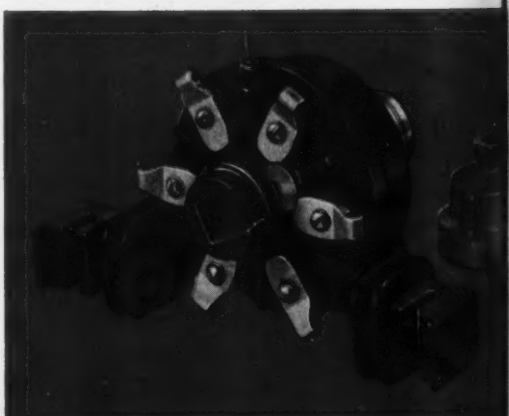
RT & E TAP

The industry—famous RT & E Tap Changer has been redesigned, and repositioned on the tank, for even greater ease in tap setting, speed and convenience in changing tap positions.

FAST 1-2 ACTION

STEP 1
Remove screw-on type cap. Note husky, hand-size gripping area.

STEP 2
Reverse cap and use as handle. That's all there is to it!



The new RT & E tap changer body is molded in one piece, multi-skirted for long creepage and high surge strength. Material used is electrical grade, wood-flour filled phenolic of high thermal stability. Contact is made through a bridging roller, under spring pressure, especially grooved around the periphery to provide double contact surfaces. This assures low resistance and cool operation.

taps

Do it faster,
safer, more
economically

dependable
pperated

CHANGER

No handhole cover to remove!
Reduces danger of tank breathing!
No lengthy expensive, tap changing time!
No confusion on tap setting!
No danger of oil contamination!

Ask your RT&E representative to demonstrate the RT&E Tap Changer or write for complete details to . . .

Engineering Talent
Concentrated on One Idea—
A Better Transformer!

RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON

C&D AutoCal*
Unitized Power-Pack

Popular mounting arrangement shows how *AutoReg*® Silicon Charger mounts inside switchgear cubicle door with controls projecting through. No manual switching or other adjustment required. PlastiCal® batteries need watering only once a year.

New C&D *AutoCal** *unitized* Power-Pack is specially designed for dependable switchgear tripping and control

Simple *AutoReg*® voltage regulated, current limiting Silicon Charger, paired with long-life PlastiCal® battery, assures high-capacity d-c power in compact package that is virtually *maintenance-free.*

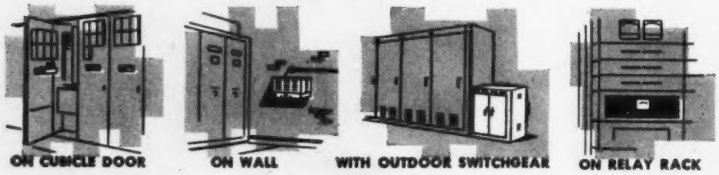
Now, utilities and industrial plants can guarantee an even greater margin of reliability and protection for switchgear and control equipment. The amazing new C&D *AutoCal unitized* Power-Pack always assures full power for tripping and control.

Here, for the first time, is a dependable, high-capacity power package *specially designed for tripping and control.* Virtually maintenance-free . . . with no manual switching or adjustment required . . . *AutoCal* provides many times the life of ordinary battery and charger combinations which may be *adapted* to this critical service.

AutoCal pairs the simple, compact *AutoReg* Silicon Charger with powerful PlastiCal lead-calcium-grid control batteries. A sudden demand for tripping power merely discharges the battery over a short period. While the breaker is tripped, PlastiCal supplies any necessary constant load current as might be required for the operation of pilot lights, holding coils, and similar requirements. Once the circuit is reclosed, *AutoReg* puts energy back into the battery at a high rate until it levels off at full charge.

Here's self-protected charging . . . no charger adjustment or maintenance . . . and 25-year-life PlastiCals only require watering once a year!

For full details—write for Bulletin AR-102 today!



ON CUBICLE DOOR · ON WALL · WITH OUTDOOR SWITCHGEAR · ON RELAY RACK

C&D

Since 1906

C & D BATTERIES, INC.

of Conshohocken, Pa.... Attica, Ind.

Sales and Service Offices in Principal Cities from Coast to Coast

Manufacturers of Styrr-Cel® Industrial Batteries • PLASTICELL* and PLASTICAL® Batteries for Communications, Control and Auxiliary Power • Producers of AutoReg® Silicon Chargers

Trademark: AutoReg® Silicon Charger and PlastiCal® Battery.

Manufacturers Briefs

(*Continued from page* 59)

ture, Type H motors and transformers in the 200 to 250 deg C range. It is scheduled for production by April. The company has exclusive license to a new extrusion process to make the sleeving, "Ben-Har 1151". BH reports it is comparable to sleevings processed by vinyl-coating or neoprene-coating, yet will cost the same. One size substituting for 3 sizes of sleevings formerly used, brings price down, reduces inventory handling. Sleeving is made from higher quality silicone compounds than previously used in the dip process. The extrusion process provides: toughness of coating, elasticity, and withstands abuse during assembly and field operation.

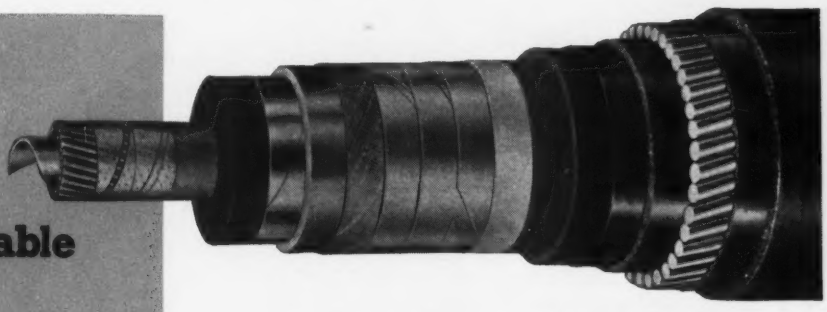
LOOK FOR . . . Precision Transformer to come out with complete line of liquid-filled transformers. Oil and askarel-filled units range from 10 kva to 5,000 kva, 69 kv . . . adoption by **Westinghouse,** for large-scale application during '59, of the insulation structure of the 30/50 Mva, class OA/FOA, 3-phase transformer (reported by E.W. Feb. 9, p 66, as first unit of this design) . . . installation of **Allis-Chalmers'** 16,000-sq-ft, 2-pass, divided water box condenser to serve 20-Mw turbine generator at Argonne National Laboratory's Experimental Breeder II station. Protection will be provided against contamination of condensate by using double tube sheets at either end of condenser . . . the industry's first "Dual-Beam" microwave system, engineered by **General Electric,** to be installed for Grant County Public Utilities District No. 2. Signals for simultaneous and continuous transmission are received and transmitted on both normal and standby RF equipment. Dual-Beam requires no switching or warm-up time and no stabilizing period . . . introduction by **Hi-Voltage Equipment Div, Joslyn Mfg,** within a few weeks, of high-speed vacuum circuit breaker equipment, 115-kv, with opening time on the order of one cycle . . . first 100-kva capacitors destined for underground system vault installation soon to be on the line for Philadelphia Electric. Shipment has been made by **General Electric's** Capacitor Dept.

experience

keeps BICC *in the lead*

Being the World's greatest cablemakers is not just a matter of size.
It's also, generally speaking, a case of knowing more than the other guy.
The experience gained from making BICC cables and accessories for every electrical purpose has helped us pioneer many developments in our field.

This 138 kV submarine cable had to be 16 miles long *–unjointed !*



The power link between the British Columbia mainland and Vancouver Island required more than 133 miles of 138kV single-conductor submarine cable, including seven 16 mile lengths — each without a single joint. Making such unjointed lengths of cable was considered to be 'impossible' in the electrical world. But BICC made and laid them with conspicuous success. Altogether some $10,000,000 of power cable contracts have been placed with BICC by the British Columbia Electric Company Ltd.

D.S.O. FOR ECONOMY

The Ductless Shaped-conductor Oil-filled cable is BICC's latest development in 33kV transmission. Dispensing with fillers and built-in ducts, it costs less than conventional cables of equal duty.

CABLES FOR THE FIRST NUCLEAR POWER STATION

BICC supplied cables and accessories for Calder Hall, England, the first nuclear power station in commercial operation. The cables include specially designed types resistant to intense radiation and heat, for operating the fuel charging and discharging grabs.

330,000 VOLT CABLE FOR KARIBA

The Kariba dam is being built on the Zambesi river to provide hydro-electric power for Central Africa.

Transmission equipment for this project is being manufactured by BICC. Altogether orders for this company total some ten million dollars and include a specially designed 330,000 volt single-conductor oil-filled cable — at present being manufactured — which will connect the underground power house to the overhead transmission lines. This will be the highest voltage cable ever installed in Africa.

BICC the World's largest cablemakers

BRITISH INSULATED CALLENDER'S CABLES LIMITED
Technical Representative in U.S.A., Arthur F. Coventry, 11 West 42nd Street, Suite 442, New York 36, N.Y.

Many improvements in distribution transformers are initiated by Pennsylvania **Pole Star** transformers

Test Programs and Committee Work Further Industry-wide Progress

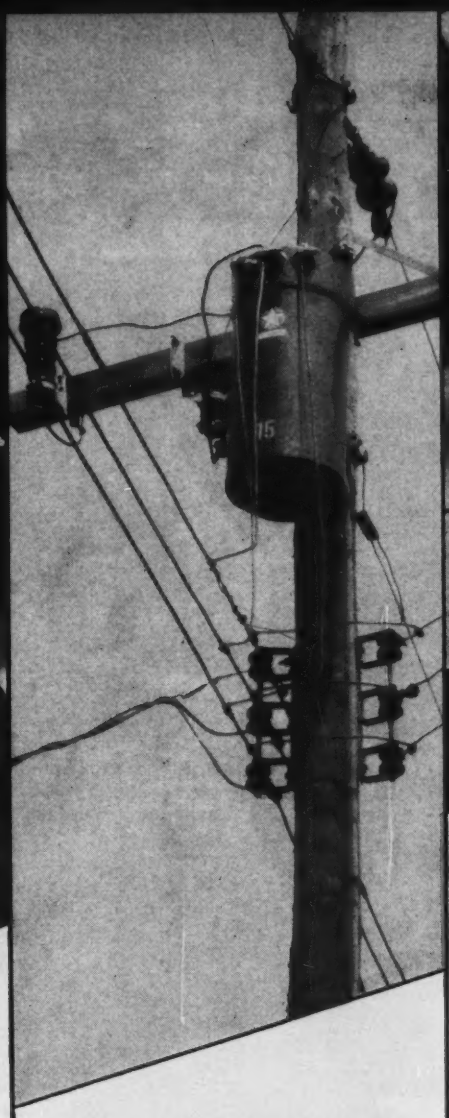
Since the inception of an AIEE program in 1956, Pennsylvania Transformer Division has been actively participating in a series of insulation life tests. By contributing time, facilities and personnel, and by taking part in other committee activities and projects of AIEE, EEI and NEMA, Pennsylvania is helping to provide the entire electrical industry with valuable information and guidance.

Pole Star's Stud-type Sidewall Bushings Eliminated Pockets

When the Pole Star was int
duced more than eleven years a
Pennsylvania pioneered the
of streamlined, leak-proof, st
type bushings. Such innovati
—when improved materials
techniques make them feasible
are typical of Pole Star leaders

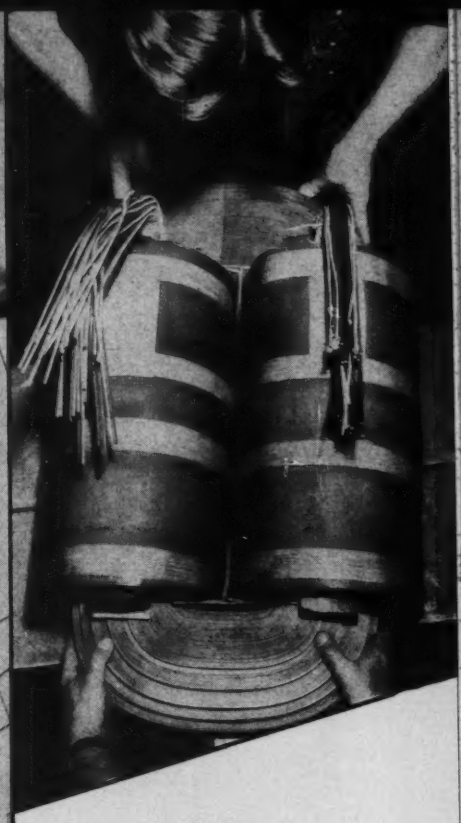
High-Strength Insulation System Gives Pole Stars Greater Life Expectancy

Introduced almost without fanfare more than four years ago, the Pole Star insulation system has been proved equal to or better than all other systems from the all-important standpoints of insulation strength and life expectancy. The system consists largely of pre-treated insulating materials that include corrugated spacers and specially processed kraft paper that possesses exceptionally high electrical and mechanical strength at higher-than-normal operating temperatures.



First Completely Sealed Distribution Transformers Now in Actual Service

The "Perfect Seal" Pole Star—a completely sealed distribution transformer—appears to be the transformer-of-the-future as a result of present trends toward the elimination of taps in many voltage classes. Working with various electrical utilities throughout the United States, Pennsylvania has distributed a number of completely sealed distribution transformers for "in service" observation and testing.



Lap-on-Top Core One of Four Basic Distribution Cores

The patented lap-on-top Pole Star core is one of but four basic distribution cores being used today. Designed to take full advantage of the inherent characteristics of cold-rolled, grain-oriented silicon steel, it is notable for its low exciting current, low core loss and consistently high quality.

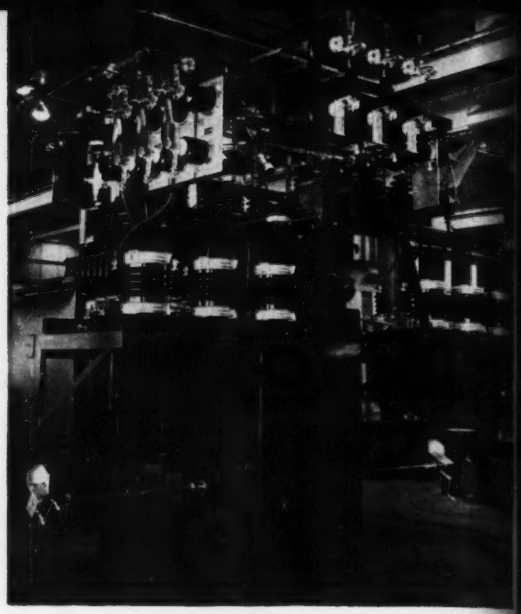
McGRAW EDISON

Pennsylvania Transformer Division

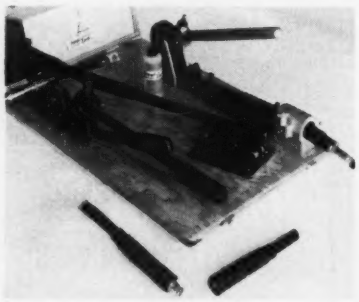
McGraw-Edison Company
CANONSBURG, PENNA.
Greater Pittsburgh District

New Equipment

Substations . . .



. . . in a new line are super compact and designed primarily for application on long, lightly-loaded rural or suburban lines. The units can be built around any GE medium transformer, 501 to 7,500 kva, 69 kv and below. Other features include low voltage line take-off in any direction, a mechanism for lowering and raising the complete recloser or recloser tank so that its internal parts are easily accessible, and easily accessible recloser disconnect switches.
General Electric Co, Schenectady 5, N. Y.



Cable Repair Kit . . .

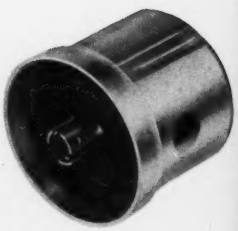
. . . is completely hand operated and uses no heat, power attachments, dies or molds. The kit includes a circumferential crimping tool, cable cutter and insulation mounting tool. Flexible cable sizes No. 4 through 500 MCM may be repaired. Terminal legs, splicing connectors and threaded cable tips are cold rolled and compressed into the connector and the cable conductor by a patented process employing three rollers mounted in an adjustable frame.
F. M. Anthony Co, 773 University Ave, Berkeley 10, Cal.

Guy Protector . . .

. . . is quickly installed. Only a simple spring clip at the top and a single bolt at the bottom are required for installation. The guy guard is made of 18 gauge galvanized steel with turned and rounded edges. No. 7628 is 8 ft long and fits rods up to 1¼ in. inclusively. No. 7627 is 7 ft in length.
Hubbard and Co, 200 S Michigan Ave, Chicago 4, Ill.

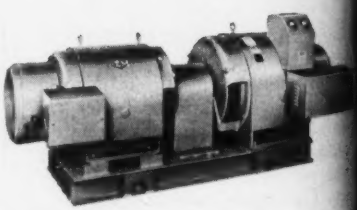
H-V Test Sets . . .

. . . test dielectric strength of insulation in generators, cables, bushings, distribution equipment and motors. The series 5700 DC HYPOT models provide facilities for non-destructive testing of high voltage equipment to locate insulation defects. Safety features include zero-reset high voltage interlock, quick-acting overload breaker and safety screen between the operator and high voltage output bushing.
Associated Research, Inc, 3777 W Belmont Ave, Chicago, Ill.



Photoelectric Control . . .

. . . provides high resistance to arc-over damage created from induced voltage surges. The control will fit mercury or filament hoods and conforms to EEI-NEMA specifications. It is also available with a cover skirt housing for luminaires not conforming to EEI-NEMA specifications. The unit, housed in a plastic globe, has a built-in lightning arrester to guard against damage from voltage surges.
Ripley Co, Inc, Middletown, Conn.



M-G Set . . .

. . . is a highly stable voltage source that will not vary more than ±2% over the load range. The four-

(*Continued on page* 71)

SEE AND HEAR
the dramatic story of
SINGLE-VENT SMALL-BORE
CUTOUT OPERATION

See the new 16mm sound and color movie "The Hubbard EHD Faultmaster" right from your own desk chair. Film time: ten minutes.

Watch the Hubbard EHD Cutout clear faults throughout the range without "null operating points"—see closure on a fault, dramatizing conclusively the *positive protection* and *safe operation* provided by the Single-Vent Small-Bore fuse cutout.

Through the use of ultra slow-motion photography, you see the fuse link melt right before your eyes...you see gases generated within the fuse tube and discharged downward and away in a single confined cone—eliminating the possibility of damage to overhead construction. You see the results of research leading to the industry's first Single-Vent Small-Bore Cutout in the extra heavy duty range.

Write the Advertising Department, Hubbard and Company for information.

No screen is needed, no threading, no rewind, no darkened room. Just plug it in and watch. Filmed at the Hubbard Electrical Research and Development Laboratory.

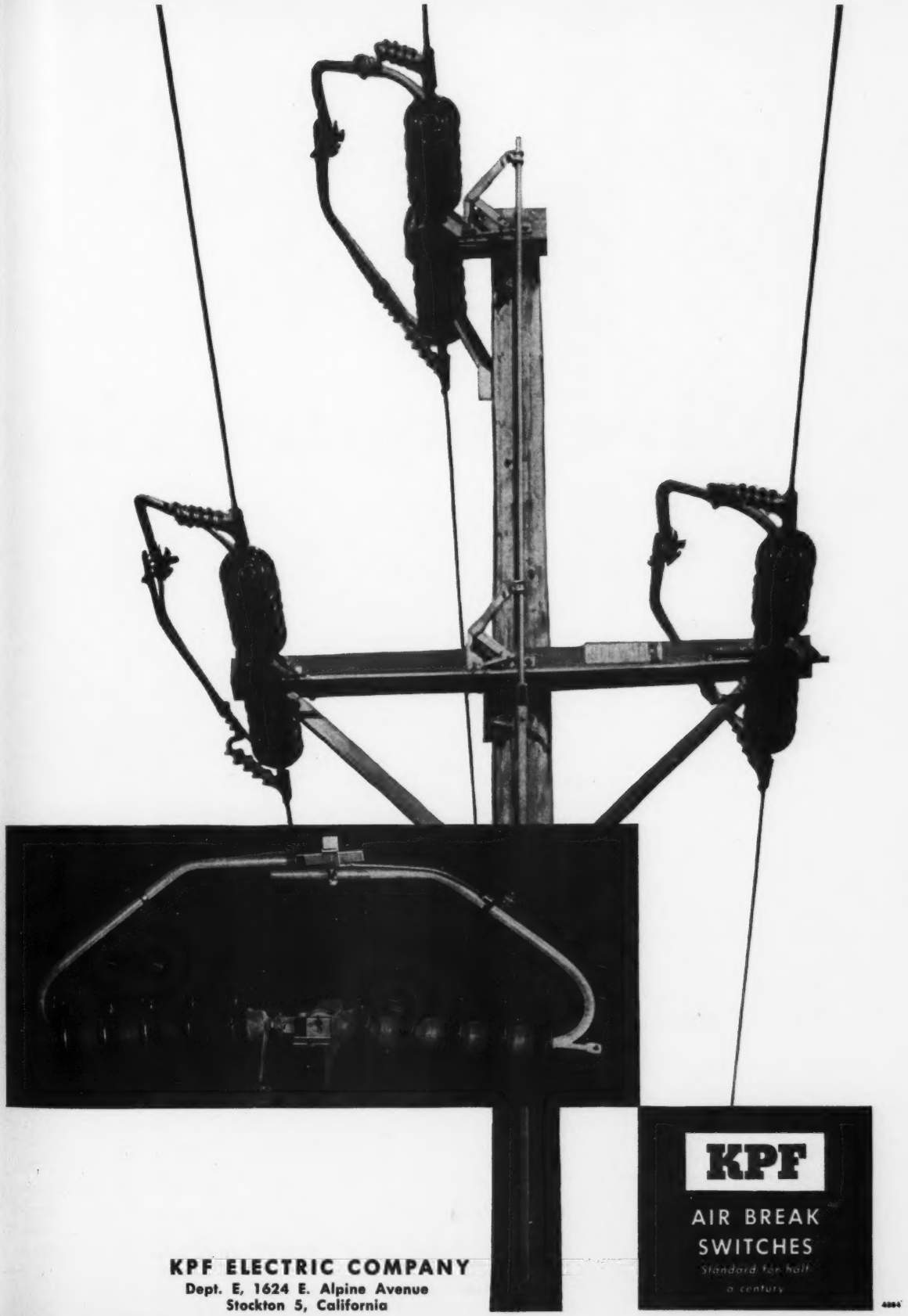
HUBBARD

AND COMPANY · 200 SOUTH MICHIGAN AVENUE · CHICAGO 4, ILLINOIS

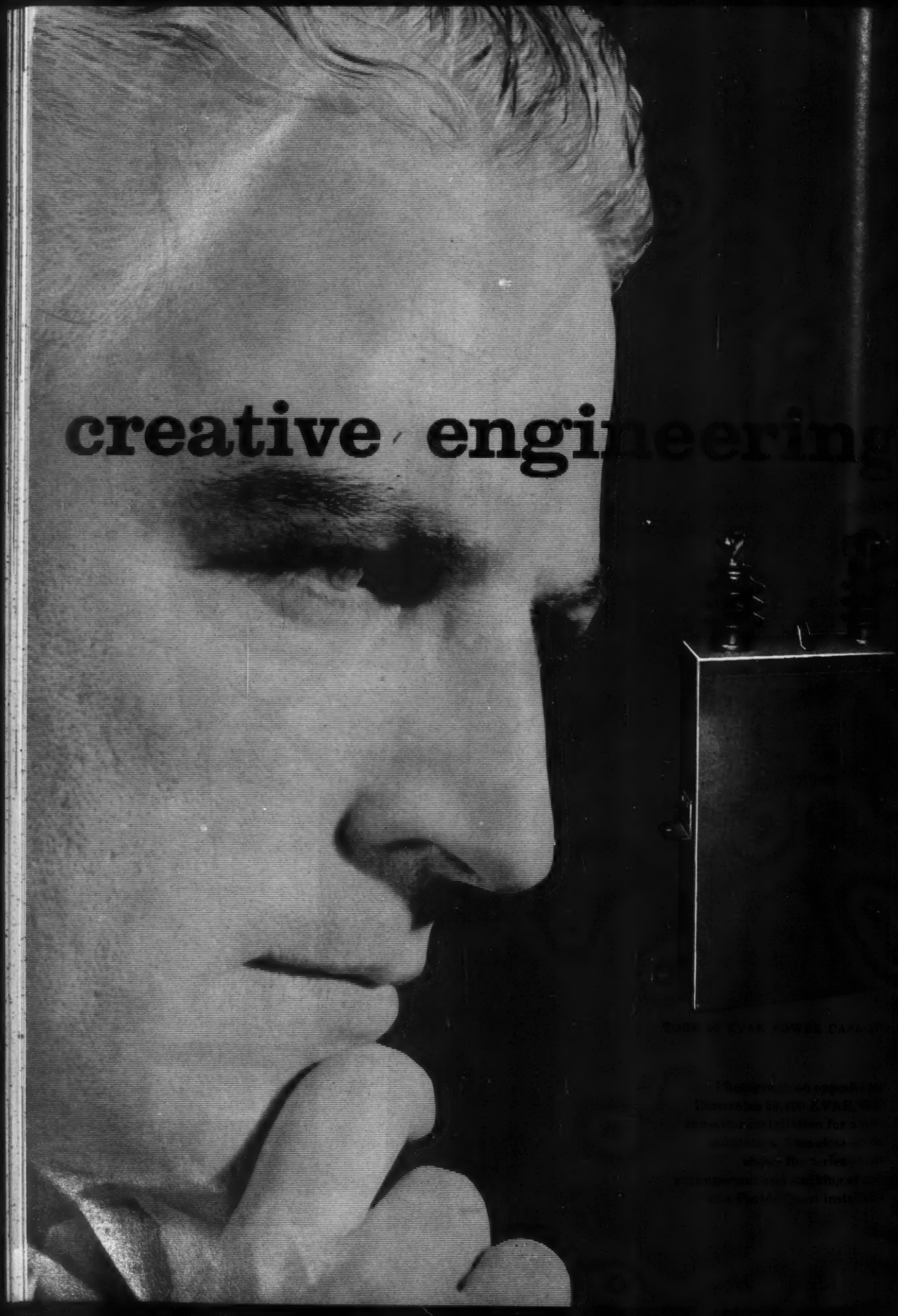
This look on a pole means KPF

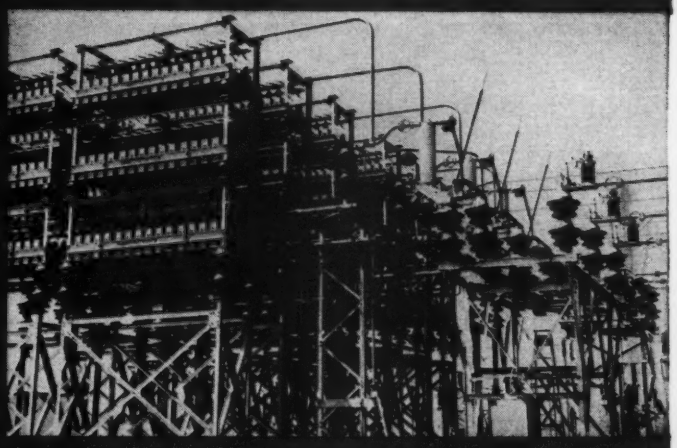
No other air break switches look like KPF, or perform like KPF. The simple, functional design of KPF switches produces a clean pole top appearance. It also insures operating dependability in all weather. There are no delicate, complex mechanisms to freeze, lock, need lubrication or wear out. The light weight of rugged KPF switches means that no extra mounting structures are required.

Lower cost KPF switches have proved their advantages in over 50 years of service on major utilities. Make a test installation this month on your own system.



KPF ELECTRIC COMPANY
Dept. E, 1624 E. Alpine Avenue
Stockton 5, California


creative engineering



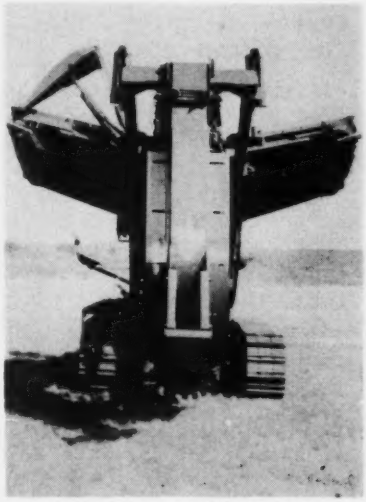
TOBE
TEMFALL
CAPACITORS

M-G Set . . .

(*Continued from page* 66)

bearing unit uses a 100-hp, 1,200-rpm, 3-phase, 60-cps synchronous motor to drive a 60-kw, 0.8 power factor, 1,200-rpm, 60-cps generator. Generator output is 120/240 v, single phase. Excitation for the motor is supplied by a free standing control cubicle containing excitation rectifiers.

Electric Machinery Mfg Co, Minneapolis 13, Minn.



Trencher . . .

. . . is equipped with V-shaped conveyor. The V-shaped conveyor provides a constant elevating angle for faster, higher spoil discharge and reduces rolling and tumbling of spoil. The 12 x 2½-ft power-shifted, power-folded attachment also provides maximum clearance under the digging wheel rims, accommodating higher heaped loads without clogging.

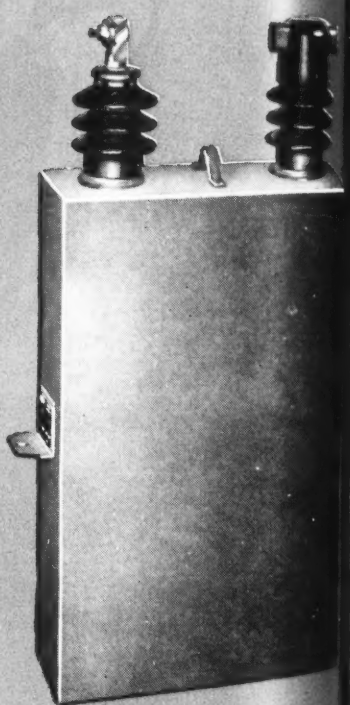
Cleveland Trencher Co, Cleveland, Ohio.

Barrier Rope . . .

. . . of polyethylene plastic has one black and two yellow strands. The $\frac{5}{16}$-in. diameter rope may be used for roping off test areas, controlling foot traffic in restricted areas, line construction and tree trimming. Known as IPCO Poly-Rope, it has a tensile strength over 1,200 lb

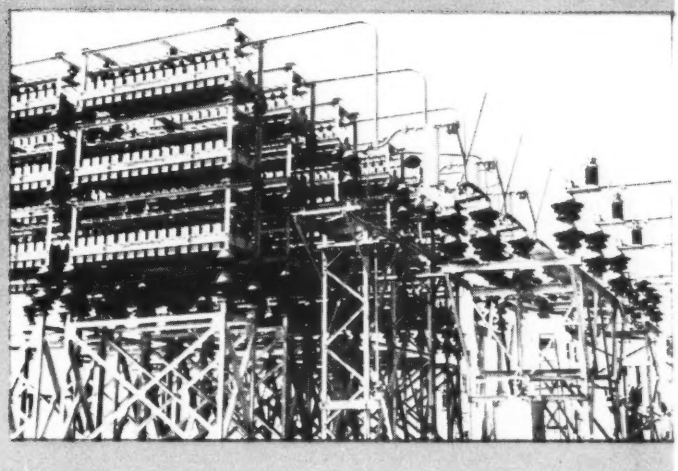
(*Continued on page* 72)

creative engineering



TOBE 50 KVAR POWER CAPACITOR

Photograph on opposite page illustrates 50,400 KVAR, 69 KV capacitor installation for a power substation. This close-up view shows the series-parallel arrangement and stacking of units at a Pacific Coast installation.



in action

NOTHING UNIQUE ABOUT UTILITIES? Some people say that all electric utilities are alike...that they all do pretty much the same job with similar equipment. Well, for some people maybe that's true. But not for Tobe.

Tobe knows that for all their similarities, no two utilities face identical problems. That's why Tobe brings to each new assignment—be it power-factor correction or thermonuclear-energy research—the fresh thinking, the unique solution, that 30 years of capacitor design and manufacturing experience can supply. That's also why the industry looks to Tobe for progress. Talk about similarities, *Tobe* and *"creative engineering in action"* are synonymous. Write for catalog today. TOBE DEUTSCHMANN CORPORATION, Norwood, Massachusetts.

TOBE TEMPALL CAPACITORS

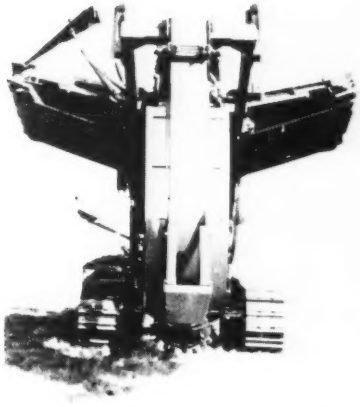
Since 1929, persistent research, trustworthy engineering, rigid production standards.

M-G Set . . .

(*Continued from page 66*)

bearing unit uses a 100-hp, 1,200-rpm, 3-phase, 60-cps synchronous motor to drive a 60-kw, 0.8 power factor, 1,200-rpm, 60-cps generator. Generator output is 120/240 v, single phase. Excitation for the motor is supplied by a free standing control cubicle containing excitation rectifiers.

Electric Machinery Mfg Co, Minneapolis 13, Minn.



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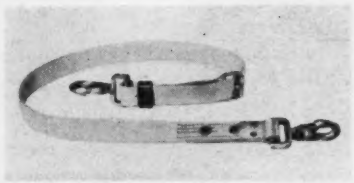
(*Continued on page 72*)

Barrier Rope

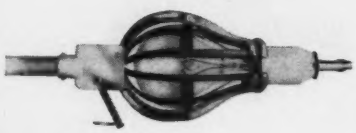
(*Continued from page* 71)

and will not sag or stretch. It has excellent dielectric properties and is not affected by oil.
Industrial Products Co, Philadelphia 33, Pa.



Safety Strap . . .

. . . has buckle hole strength of 2,100 lb. Constructed of yellow neoprene nylon, it is furnished with a 2-ply red safety center. Known as the "N" Series, the strap is available in a complete range of lengths.
Miller Equipment Co, Inc, Franklin, Pa.



Lamp Puller . . .

. . . features a locking mechanism preventing the most common type of lamp breakage. Once placed in position on an insulator collar, the unit is automatically locked there until released by repairman. Total weight of the unit is only 2⅛ lb (exclusive of pole).
Marsto Machine Co, Inc, 231 Willard St, Quincy 69, Mass.

Luminaire Support . . .

. . . allows user to quickly lower luminaire to stepladder height for servicing. Known as Self-Service Support, the aluminum unit features a boom rise of 5 ft and a one-piece pole plate designed for pole, pipe, or flat wall mounting. The lowering force of the boom is cushioned by two stainless steel torsion springs. A chain hand line is held in tension by a torsion latch-spring device.
Line Material Industries, McGraw-Edison Co, Milwaukee 1, Wis.

I wish we had more time and personnel to prepare for this rate case!

Your staff is overloaded now. Call in the specialists and let them carry the peak load. HOW ABOUT PIONEER?

GIVE YOUR NON-ROUTINE OPERATIONS TO PIONEER

Design and Consulting Engineering Services

Pioneer has specialized in designing power plants for 57 years. It designs fossil fuel, hydro and atomic plants. It forecasts load growth, selects sites, purchases and expedites equipment and supervises construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters

Pioneer offers services in all phases of Federal, State and Local regulation including rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services

Pioneer's services in corporate matters include business and management engineering advice, financial, accounting, tax counsel, insurance, and pension planning. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW!

On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes, illustrates Pioneer's engineering services, and corporate services, from financing to operation.

57 YEARS

Pioneer Service & Engineering Co.

231 South La Salle Street
Chicago 4, Illinois

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors: URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Aluminum Conductors: Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	**230**	105	**87.4**
4	155	170	163	**143**	73.3	**53.3**
6	103	115	108	**91.5**	51.5	**35.0**
Solid						
2	239	260	232	**219**	92.2	**79.2**
4	151	164	152	**136**	64.0	**48.0**
6	100	112	101	**87**	45.7	**31.7**

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean . . . free-stripping . . . has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits . . . when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous . . . tough . . . resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

When you order covered wire and cable, make sure the coating is made with PETROTHENE® polyethylene resins. PETROTHENE polyethylene costs no more, but it gives you premium weather and stress-crack resistance.

Polyethylene's advantages are outlined in an informative new U.S.I. data sheet, "Polyethylene . . . The Best Line Wire Covering." Also available is a data sheet showing properties, applications and specifications of PETROTHENE polyethylene compounds. Send for your copies today.

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Graphs Determine Distribution

Curves determine distribution source zero-sequence reactance (X_0) necessary to

J. E. **SKUDERNA**, Electrical Engineer, Commissioner's Office, U. S. Bureau of Reclamation, Denver, Colorado

To determine source-end grounding requirements:

- Express maximum allowable conductor-to-ground voltage at a given point on the line in per-unit of maximum normal conductor-to-ground operating voltage.
- Determine mileage from source end to the given point.
- Enter appropriate curve set to find required source X_0/X_1 for a given conductor size.
- Multiply by X_1 to find allowable upper limit for source X_0.

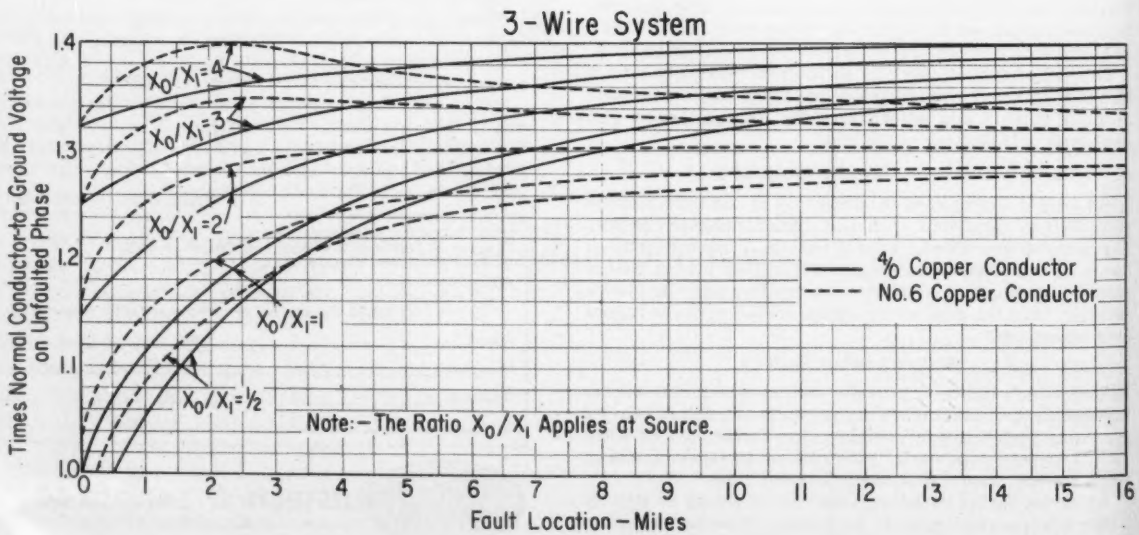
The curves apply directly when positive-sequence reactance of the supply system X_1 (viewed from source) is 3 ohms per phase. For different X_1, multiply problem line mileage by $3/X_1$ to obtain mileage for entering curves.

Ground faults on distribution radials which are inadequately grounded at the source can cause severe rises in conductor-to-ground voltage along the line, whether the line is 3-wire, or 4-wire with conductor-to-ground distribution transformers.

Therefore, evaluation of the source end grounding is required to assure protection for conductor-to-ground connected equipment on the circuit. Accompanying curves aid determination of source-end grounding requirements. The curves specify the minimum zero-sequence source reactance X_0, required to limit conductor-to-ground 60-cycle voltages anywhere along the line to acceptable values. Usually such values correspond to arrester reseal rating.

Bases for Curves

In plotting the curves, effects of system load were neglected. Conductor-to-ground voltage plotted is the highest calculated for the unfaulted conductors. Source and fault resistances were assumed zero, but line resistance was taken into account.



Source-End Grounding Requirements

limit voltage rise on unfaulted conductors to acceptable values during ground fault

Following line impedances were used in calculating the curves. They were selected to cover commonly used conductor sizes.

	4-wire system	3-wire system
4/0 copper	$Z_1 = 0.278 + j0.615$	$Z_1 = 0.278 + j0.615$
	$Z_0 = 0.564 + j1.890$	$Z_0 = 0.564 + j3.150$
No. 6 copper	$Z_1 = 2.180 + j0.756$	$Z_1 = 2.180 + j0.756$
	$Z_0 = 2.930 + j2.770$	$Z_0 = 2.470 + j3.290$

where Z_1 and Z_0 respectively are positive- and zero-sequence line impedances in ohms per mile. The curves will give conservative results if used for lines with conductor size greater than 4/0 copper.

Example

Assume a 12.47-kv 4-wire multi-grounded distribution line supplied by an ungrounded power transformer in conjunction with a grounding transformer, and 9-kv arresters protecting load transformers located 2 miles out on the line. Source X_1 is 1.5 ohms per phase, line conductor is No. 6 copper, and the operating voltage at the arresters does not exceed 12.47-kv line-to-line.

PROBLEM

Determine grounding transformer reactance required at source end to restrict voltage rise on unfaulted conductors to arrester reseal rating in event of a ground fault on the line.

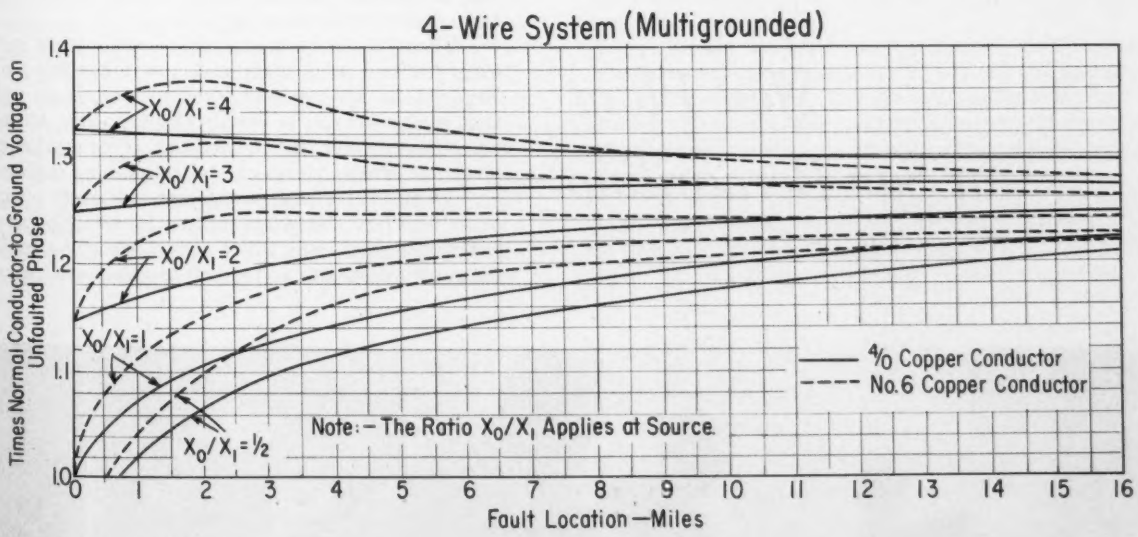
SOLUTION

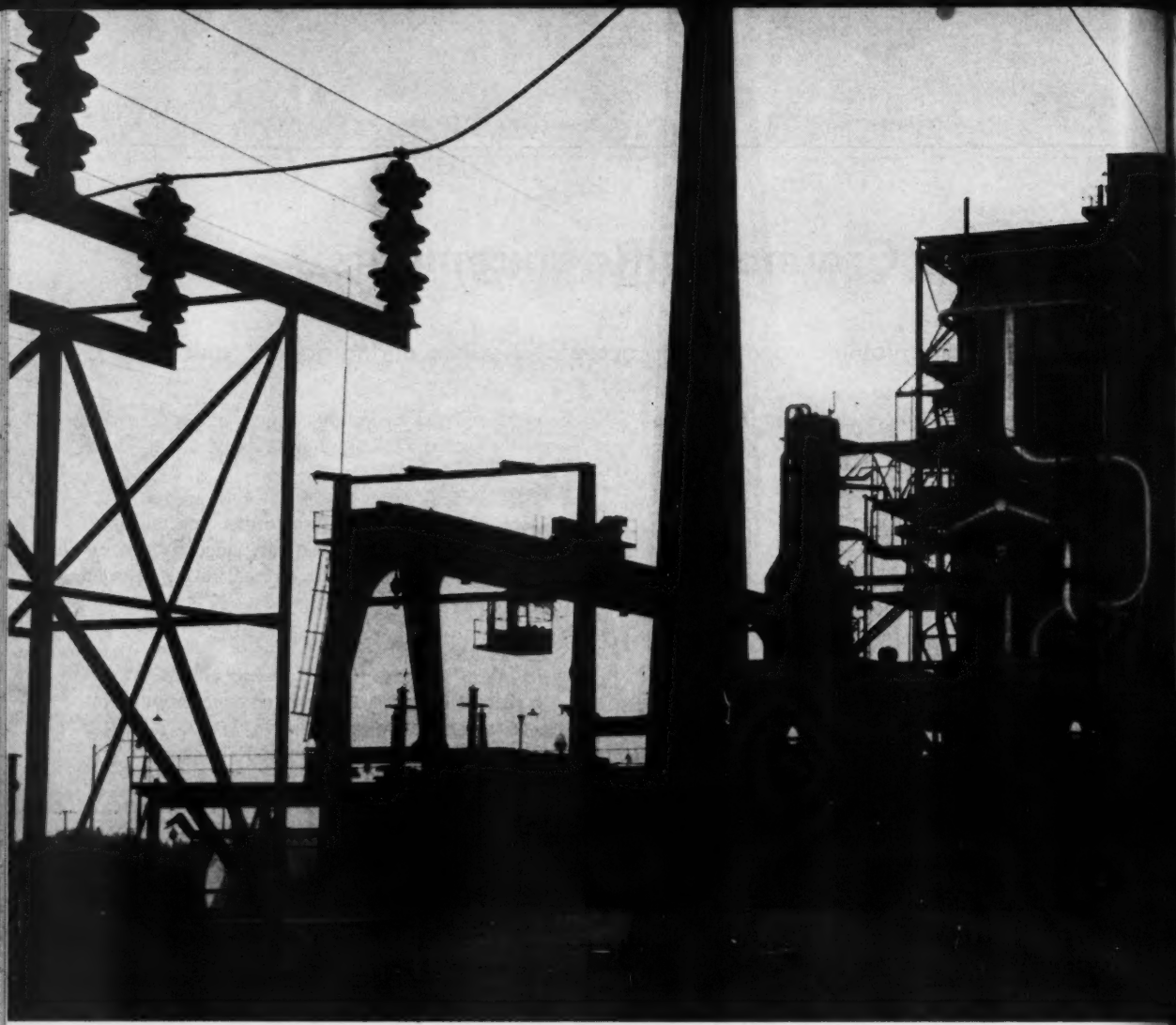
1. Maximum allowable conductor-to-ground voltage at the arrester location is $(9\sqrt{3})/12.47 = 1.25$ times normal conductor-to-ground voltage.

2. Equivalent mileage for entering the curves is $(2\times3)/1.5 = 4$ miles.

3. The 4-wire system curves indicates source X_0/X_1 should not exceed 2.

4. Grounding transformer reactance X_0 should not exceed $2 \times 1.5 = 3$ ohms per phase.



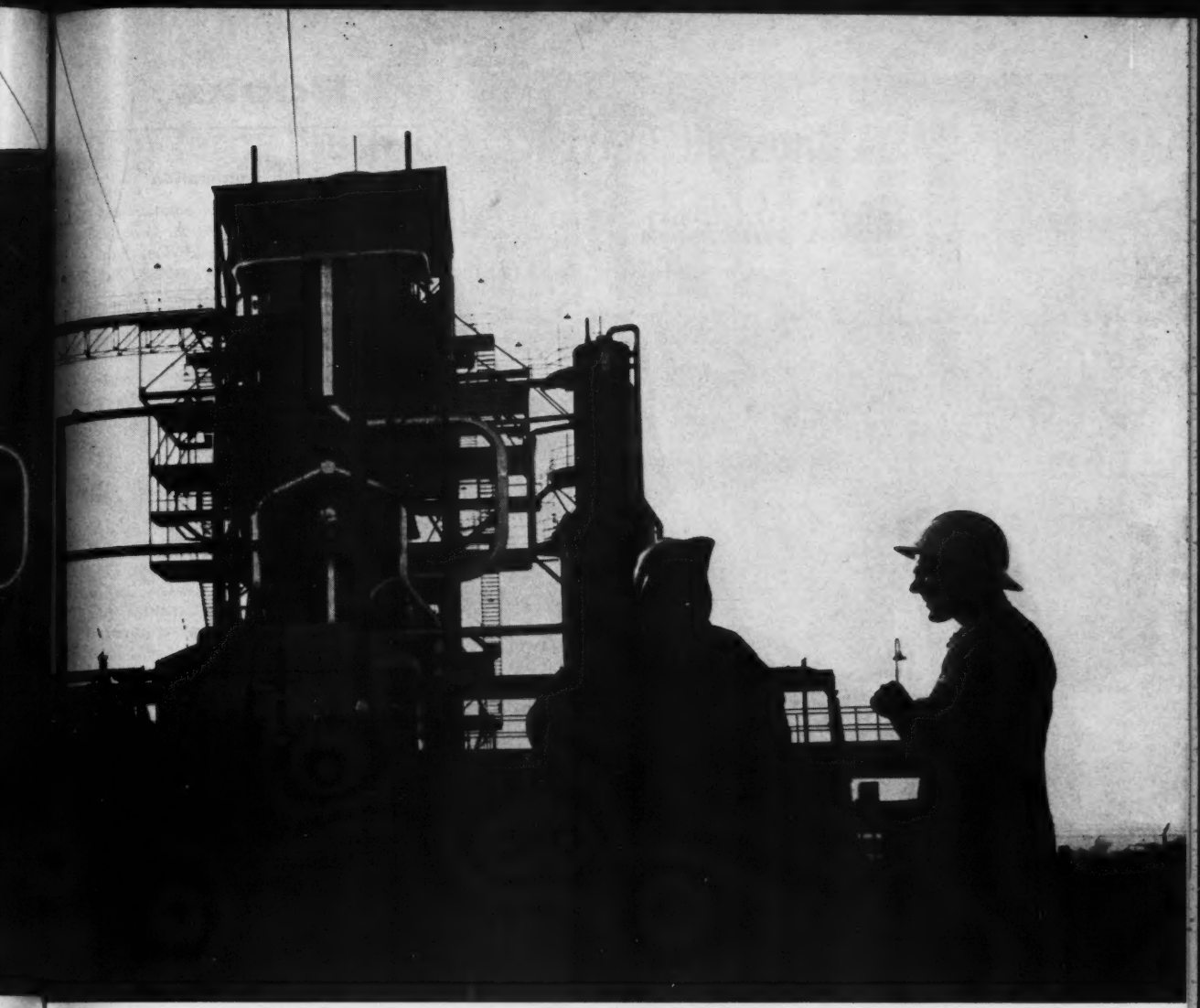


New Plant at San Bernardino

The two-unit, 132-m.w. steam plant recently completed at San Bernardino for California Electric Power Company has a number of unusual features.

There are only two operating levels—grade and firing aisle. A broad ramp permits access to the firing aisle by large trucks, and on both levels clearances are ample so that equipment can be serviced by fork-lifts. All rotating equipment, except turbo-generators, is mounted at ground level, minimizing vibration and simplifying maintenance.

All feedwater heaters, together with many pumps and other auxiliary items, are located in a bay between the two turbo-generators, where they are easily accessible to the gantry crane and to fork-lift maintenance trucks.



The plant burns natural gas or heavy residual fuel oil. A unique oil pumping system eliminates the need for heated lines from storage to day tank.

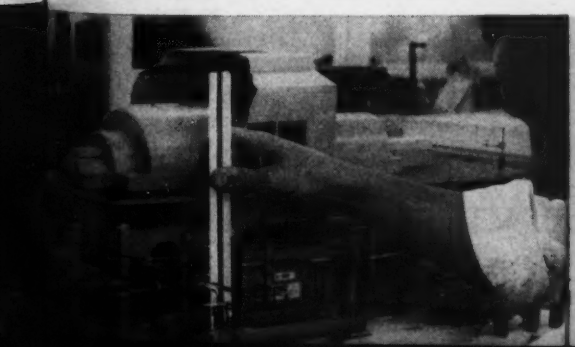
All principal water tanks are combined into two 82-foot "pisa towers" which support the deaerators, and all sweet-water condensates drain into two collecting wells sunk 42 feet below ground level.

The plant is operated by three men per shift. Both units were completed ahead of schedule and below the cost estimate, and both were placed in commercial operation within two weeks after first roll-over.

Structural layout and all important details were worked out on a scale model before any drafting was done. Calectric engineers were able to watch their plant grow in three dimensions, approving each detail as it was added to the model.

The plant was built by Fluor under a total-responsibility contract covering economic study, design, engineering and construction. This arrangement enabled Calectric to exercise complete day-to-day control over the entire course of the project, in close liaison with Fluor project management.

The Fluor brochure, "Calectric's San Bernardino Steam Plant," describes this unusual station in detail. Write to Department #24, The Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.



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Electronic digital computer permits load-flow calculations on networks of up to 100 busses and 270 lines at lowest cost

Gives you optimum level efficiency in production, sales, purchase!

The lowest-priced complete computer you can buy, the versatile LGP-30 saves you time and money by 1) economically solving your load-flow problems; 2) forecasting optimum turbine-generator and boiler usage under varying conditions of system demand; 3) optimizing purchase and sales of power.

Now at work serving numerous electrical utilities, the compact, mobile LGP-30 operates from any convenient wall outlet . . . requires no expensive air-conditioning or installation. It gives you twice the capacity of any computer in its class, yet is by far the easiest to program in basic machine language.

Internal components of the LGP-30 have been greatly reduced to insure highest reliability. Operation has been remarkably simplified. Your personnel are quickly trained by Royal McBee without charge. Sub-routines and programs are available – as well as membership in an active users organization. Sales and service facilities are maintained coast-to-coast. For further information and specifications, write Royal McBee Corporation, Data Processing Division, Port Chester, N.Y. In Canada: The McBee Company, Ltd., 179 Bartley Drive, Toronto 16.

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Books

Source Book on Automation

Handbook of Automation Computation and Control, Vol. I. Edited by E. M. Grabbe, Simon Ramo and D. E. Wooldridge. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y. 967 pages, illustrated. Price $17.00.

This volume is a very comprehensive treatment of control fundamentals. It was edited and written by a staff of experts. Its two companion volumes cover computers and data processing (vol 2), and systems and components (vol 3). Almost half of this first volume is devoted to mathematics fundamental to computers. The remaining chapters are devoted to numerical analysis, operations research, and information theory.

A very thorough background in mathematics is required for an understanding of this book.

Handbook

Mark's Mechanical Engineers' Handbook —6th Edition. Revised by 100 specialists. Edited by Theodore Baumeister. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St, New York 36, N. Y. 2,304 pages, illustrated. Price $23.50.

Since its first edition appeared over 50 years ago, Marks' Handbook has won acclaim as a standard reference of mechanical engineering.

The latest edition—the sixth—adheres to the original precept of contributions from leading engineers compiled to give the broadest possible coverage of factual material. In it, nuclear power, computing machines, and jet propulsion take their place alongside the more conventional fields of mathematics, physics, lubrication, steam boilers and strength of materials.

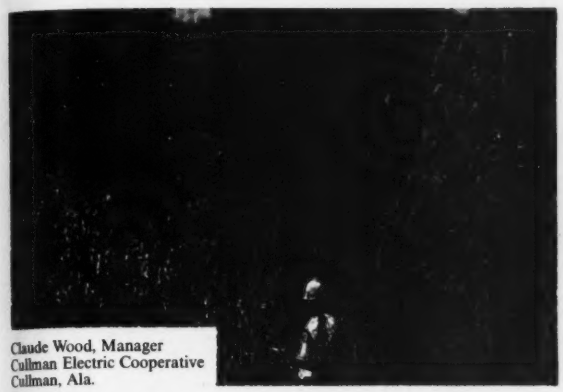
Books Recently Received

Practical Speaking for the Technical Man. By J. E. Dietrich and Keith Brooks. Published by Prentice-Hall Inc, 70 Fifth Ave, New York 11, N. Y. 306 pages, illustrated. Price $6.60.

Sodium Graphite Reactors. By Chauncey Starr and R. W. Dickinson. Published by Addison-Wesley Publishing Co, Inc, Reading, Mass. 278 pages, illustrated. Price $6.50.

How users get

long-term brush control from Du Pont AMMATE® X without injury to nearby crops



Claude Wood, Manager
Cullman Electric Cooperative
Cullman, Ala.

"We started a chemical brush control program three years ago with 'Ammate'. We have observed a good kill of brush and are very satisfied with results. Our system serves an area in which cotton is the main crop and we have not experienced a single liability claim on any crop with 'Ammate'."

K. P. Hudson, Assistant Manager
Appalachian Electric Cooperative
Jefferson City, Tenn.

"By the end of the 1959 foliage spray season, we will have had all the brush under our 1,150 miles of line completely sprayed. We are highly pleased with the brush kill obtained and the safety factor of being able to spray 'Ammate' near tobacco because this is the number one crop in our area."

William D. Towers
Holston Electric Cooperative
Rogersville, Tenn.

"Right-of-way brush control has been an annual operation because of the heavy rainfall—60 inches—and rapid growing brush species. In the summer of 1957, we arranged with a contractor to set up a planned chemical program. 'Ammate' was selected for the job because it can be safely used next to tobacco fields and is most effective on the brush species in this area. The results of these two years' 'Ammate' spraying have been most satisfactory."

H. G. Gangwer, Sr. (Pres. Tenn. REA)
Manager, Fort Loudon Electric Coop.
Madisonville, Tenn.

"We have 1,253 miles of right-of-way running through rugged terrain and brush control had been our major line maintenance cost. Five years ago we initiated an 'Ammate' brush control program and we have had very satisfactory results. We have already realized great savings in maintenance costs and we feel that in the future, right-of-way expense can be held to a minimum by continuing our present program."

The successful experiences as told above are typical of the many users of Du Pont "Ammate" X weed and brush killer. "Ammate" X assures lower-cost, longer-term brush control because when the original spray job is done well, only occasional spot sprays are required to keep brush under control for subsequent years. "Ammate" X is the brush killer to use on rights-of-way that adjoin sensitive crops such as cotton, tobacco, tomatoes, soybeans, grapes, peanuts, since it presents no volatility hazards.

Around sub-stations, pole yards or wherever weeds and grass make maintenance difficult and costly, use Du Pont "Telvar" monuron or "Karmex" diuron weed killer.

This season, try new "Dybar" fenuron weed and brush killer. "Dybar" kills brush through root action. It comes in pellet form for easy spreading, even in hard-to-reach areas. Recommended for use East of the Rocky Mountains.

Du Pont weed control specialists are ready to help you choose the proper chemicals for an efficient and economical brush and weed control program. Write Du Pont, Grasselli Chemicals Department, D-4036, Wilmington 98, Delaware.

On all chemicals, always follow label instructions and warnings carefully.

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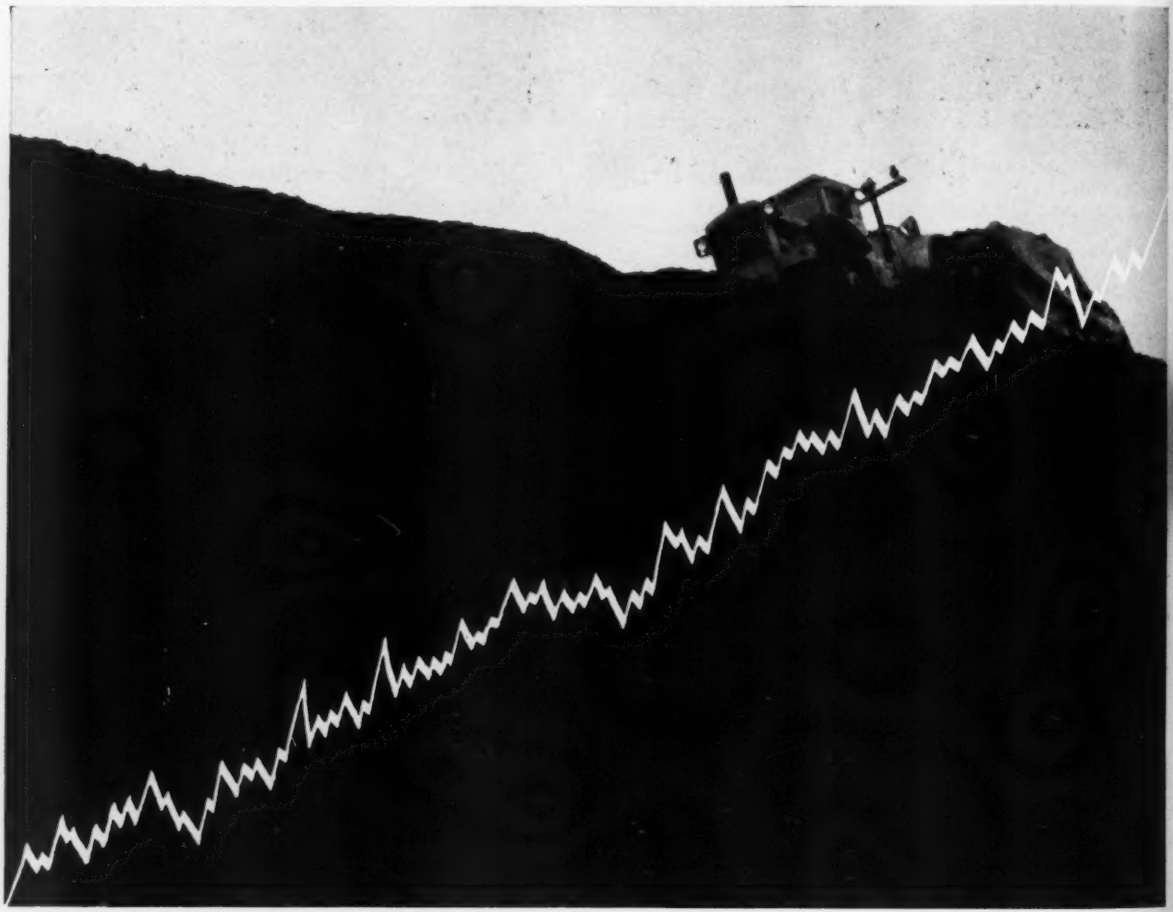
TELVAR® monuron weed killer
KARMEX® diuron weed killer
DYBAR® fenuron weed killer

it is reassuring to utilities,

as they project the demand for power in their areas in the decades ahead . . . to know that career coal companies like Island Creek stand ready to deliver all the coal they will need. Island Creek's vast reserves,* modern mining methods and scientific preparation assure continuity of supply far into the future. Our engineers would welcome an opportunity to talk with yours.



Island Creek's vast, proven, available reserves total more today than Island Creek has taken out of the earth in the past 50 years.

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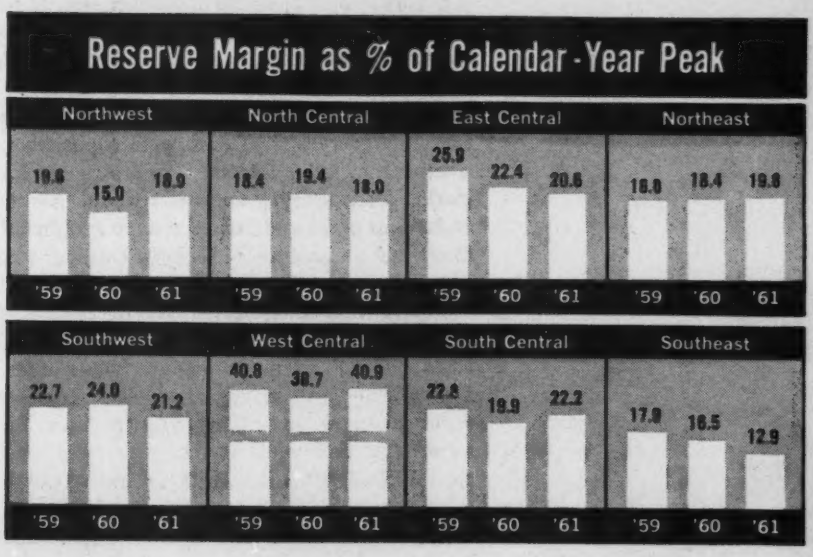
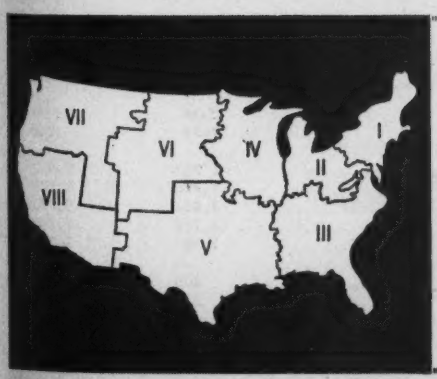


A New Look at Reserve Margins

Report on Electrical Business Outlook

The power industry's reserve margins are not so large as they look. According to Edison Electric Institute's 1958 Year-End Summary of the U. S. Electric Power Situation, the industry maintained a 26.6% gross margin over the December 1958 peak loads. And EEI's 24th Semi-Annual Electric Power Survey, published last fall, estimates gross margins over December peaks for the next three years will exceed 23%, assuming median hydro conditions. EEI's figures are perfectly accurate, so long as you consider the yardstick against which they are measured—the December peaks. The point is that rapidly growing summer peaks have warped the yardstick, and meaningful margins can now be obtained only by measuring them on a regional basis over the peak for the calendar year.

The calendar-year method shows margins to be ample, but not excessive. The chart above shows regional reserve margins over calendar-year peaks for 1959, 1960, and 1961, based on EEI's published estimates of capability and peak loads. Nationally, gross margins over calendar-year peaks run about four percentage points lower than margins over December peaks for each of the three years.



Reserve Margin over Calendar-Year Peaks

Power Region		1959 Mw	1959 % of Peak	1960 Mw	1960 % of Peak	1961 Mw	1961 % of Peak
I	Northeast	5,086	18.8	5,294	18.4	6,085	19.8
II	East Central	6,151	25.9	5,688	22.4	5,545	20.6
III	Southeast	4,504	17.9	4,534	16.5	3,819	12.9
IV	North Central	2,685	18.4	3,047	19.4	3,039	18.0
V	South Central	3,293	22.8	3,221	19.9	3,949	22.2
VI	West Central	1,088	40.8	1,120	38.7	1,276	40.9
VII	Northwest	2,060	19.6	1,721	15.0	2,282	18.9
VIII	Southwest	2,697	22.7	3,076	24.0	2,907	21.2
	TOTAL U. S.	27,564	21.2	27,701	19.7	28,902	19.2

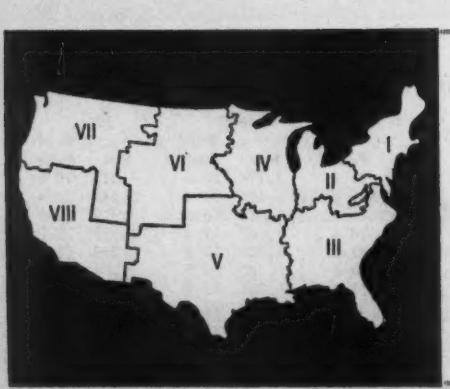
Why measure reserve margins over calendar-year peaks? Here's an example: In 1958 Region V—the South Central Region—showed a 69.7% gross margin over the December peak. But the actual reserve of capability over the calendar-year peak, which occurred in summer, was 23.6%. For the entire U. S., calendar-year peaks exceeded December peaks by some 3.3 million kw, according to EEI's 1958 summary, and estimates for the future show even greater spreads.

Calendar-year peaks are the ones that influence utilities' capital spending. Certainly every system must plan capacity in terms of its own annual peaks, whether they fall in December or in August. Ideally, any analysis of the potential market for generating apparatus would have to take into consideration the calendar-year peaks and desired reserve margins of each individual system. But it is likely that an analysis of regional calendar-year peaks would give a rough idea of how much generating equipment the utilities in that region might want to order for installation before the peak is due.

Let's see what a regional analysis shows about the 1959 and 1960 markets for generation. This analysis involved several assumptions: First, lead time from order placement until the equipment is on line was taken as three years. This means that equipment to meet the 1962 peak would be orderd in 1959, and capability for 1963 would hit the order book in 1960. Second, desired regional reserve margins were taken to be 18% over calendar-year peaks, assuming median hydro. Individual systems might choose a smaller margin, but on the other hand, some duplication of facilities is likely within each region. Third, the rate of growth of winter and summer peaks in each region in 1962 and 1963 was assumed to be the same as the rate from 1954 to EEI's estimated 1961 figure.

In order to estimate the size of the 1959 market for generation, this procedure was followed: **1.** Project growth rates of winter and summer peaks for each region to obtain peak estimates for 1962. **2.** Select the higher, and increase its value by 18% to obtain an estimate of desired regional capability to meet the calendar-year peak. **3.** From this desired capability, subtract EEI's estimated capability at the time of the regional peak in 1961 to get the desired capacity additions needed to maintain an 18% reserve margin in 1962. **4.** Subtract capacity additions already scheduled for 1962, to obtain the amount of generation that is still to be ordered in each region to meet the expected 1962 calendar-year peak. The same method was followed to arrive at the 1960 potential market, assuming that all potential 1959 orders were actually placed.

Potential orders for 1959 and 1960 are 13.8 and 14.8 million kw respectively, under these assumptions. Interestingly enough, the 1963 gross margin over that year's December peak would exceed 25%, and yet each region would be maintaining exactly an 18% reserve over its calendar-year peak. The reason for this large difference, of course, is that summer peaks are expected to grow faster than winter peaks. In both 1962 and 1963, four regions will show their annual

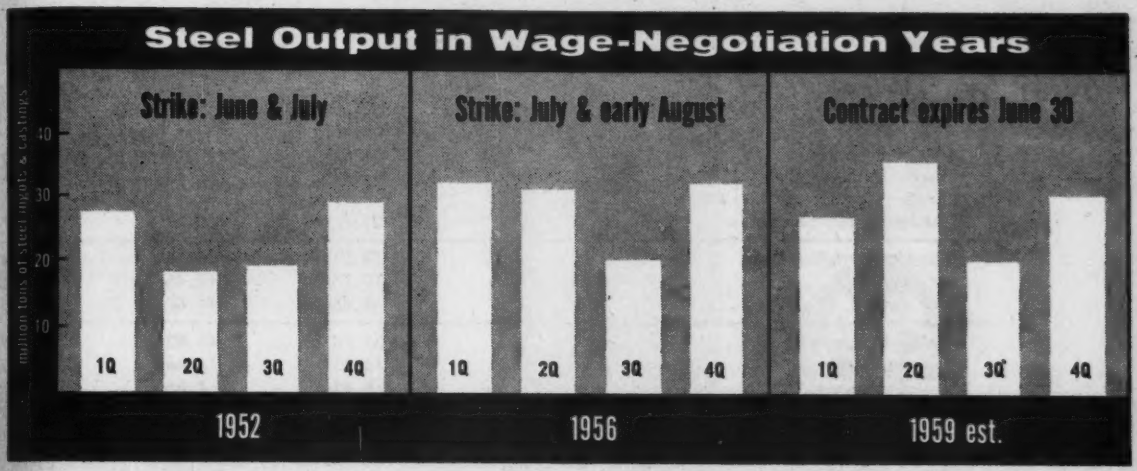


Potential Orders for Generating Units (Mw of Capacity)

		Year 1959	Year 1960
I	Northeast	741	2,062
II	East Central	1,440	2,770
III	Southeast	4,951	3,770
IV	North Central	4,134	1,480
V	South Central	1,181	2,298
VI	West Central	0	0
VII	Northwest	636	1,010
VIII	Southwest	714	1,440
	TOTAL U. S.	13,797	14,830

peaks in summer, assuming that winter and summer peaks continue their expected 1954-1961 growth rates for two more years. The four will be: North Central, South Central, West Central, and Southwest.

The objective of this study is not to arrive at an iron-clad prediction of the 1959 and 1960 markets for generating apparatus. It involves too many assumptions for that. But it does demonstrate how gross margins can be deceptive when they are measured over December peaks, and how a December gross margin of 25% or more does not necessarily mean that the electric power industry is burdened with excess capacity.

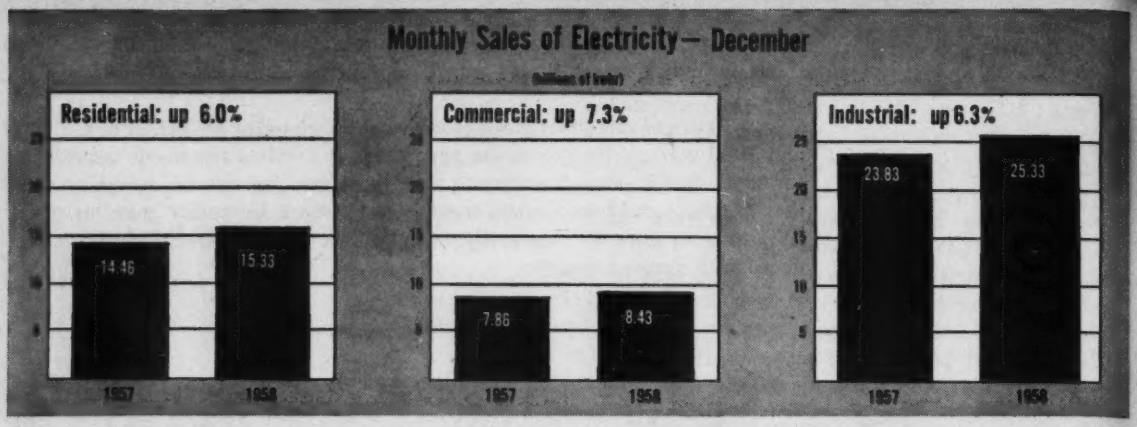


Steel and Business: The Tail Wagging the Dog?

The well-advertised labor negotiations due to hit the steel industry at the end of June have already begun to shake the economy. In the past few weeks, the build-up of steel inventories has resolved any doubts that business will be rising through the spring and on into the summer. But what about the second half of 1959? Will the economy lose its steam if the steelworkers go out?

The outlook is that business will keep on rising throughout the year, even though the excitement aroused by the threat of a steel strike may mean that it will be moving up somewhat faster in the spring than later on. The steel industry itself accounts for only about 5% of the Federal Reserve Board's Industrial Production Index. A steel strike can only drag down the rest of the economy if it results in a shortage of steel needed in other industry, and a steel shortage is not likely this summer. By the end of June, inventories of steel will be 6 to 7 million tons higher than at the beginning of the year—high enough to sustain a strike of six or seven weeks before many steel users feel the pinch.

The third quarter is almost certain to be a slow one for the steel industry—strike or no strike. If there's an early settlement, industry will just cut back its inventories. But the steel business is likely to pick up again in the fourth quarter. Past experience in strike years shows that steel production slumped during the quarters in which the strikes took place, but rebounded in the final quarter. Industry economists believe that will be the pattern in 1959. They expect production for the year to run around 110 to 115 million tons, and they don't look for declines in overall economic activity in the second half.



Power Statistics

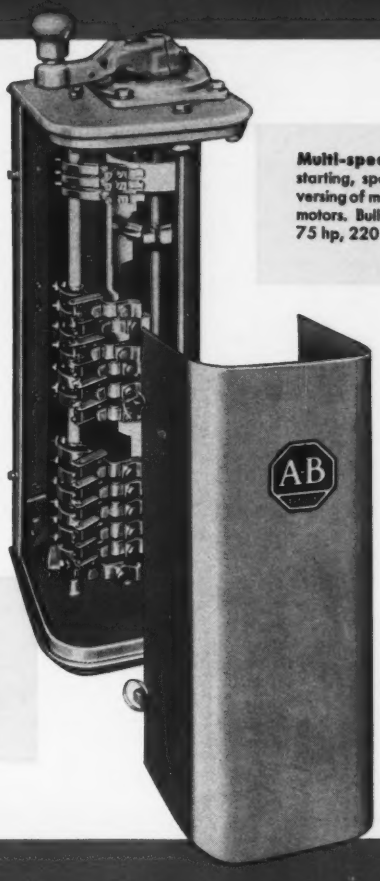
		Latest Month	Year Ago	Annual Change %
Capacity	Dec.	142.41	128.74	10.6
Peak—Class I Systems, million kw	Dec.	107.1	102.4	4.6
Estimated Dec. '58 Peak	Dec.	125.7	130.5	– 3.7
Production—billion kwhr	Dec.	59.21	54.13	9.4
Hydro		10.75	12.43	–13.5
Fuel		48.46	41.60	16.5
Sales—billion kwhr	Dec.	51.78	48.62	6.5
Residential		15.33	14.46	6.0
Commercial		8.43	7.86	7.3
Industrial		25.33	23.83	6.3
Other		2.68	2.47	8.5
Fuel Consumption	Dec.			
Coal—million tons		15.97	13.95	14.5
Oil—million barrels		9.22	7.05	30.8
Gas—billion cu ft		90.10	90.89	– 0.9
Net Income Class A & B Co's—$ million	Dec.	150.27	140.68	6.8
Residential Customers—millions	12 mos.	47.79	46.86	2.0
Revenue per kwhr	ended	2.53¢	2.56¢	– 1.2
Avg kwhr per customer	Dec. 31	3,366	3,174	6.0
Avg annual bill		$85.16	$81.25	4.8

Business Statistics

Indexes: 1947–49 = 100				
FRB Industrial Production	Feb.	145	131	10.7
ENR Construction Cost	Mar.	163.8	156.1	4.9
BLS Cost-of-living	Jan.	123.8	122.3	1.2
New Orders for Machinery (1950 = 100)	Jan.	157	122	28.7
NEMA Sales				
Insulation materials	Dec.	124	112	10.7
Electric appliances		95	66	43.9
Wholesale prices				
Motors and generators	Dec.	146.0	143.3	1.9
Transformers and regulators		148.8	149.2	– 0.3
Switchgear and fuses		172.0	171.2	0.5
GNP—annual rate—$ billion	4th qtr.	453.0	438.9	3.2

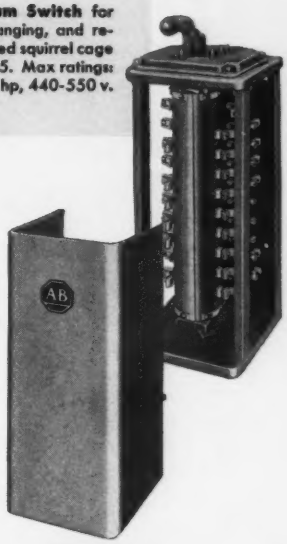
Significant changes: Appliance sales, as measured by NEMA's index, rose a point in December—a good sign, since they usually fall at Christmas time. The index topped year-ago levels by 44%.

Reversing Drum Switch for across-the-line starting and reversing a-c and d-c motors. Interlocks available. Bulletin 350. Max ratings: A.C. 20 hp, 220v; 40 hp, 440-550v. D.C. 3 hp, 115-230v.



Speed Regulating Drum Switch for starting and regulating duty of wound-rotor motors. Bulletin 375 non-reversing. Max ratings: 500 hp, 220-440-550 v. Bulletin 385 reversing. Max ratings: 60 hp, 220 v; 75 hp, 440-550 v.

Multi-speed Drum Switch for starting, speed changing, and reversing of multi-speed squirrel cage motors. Bulletin 365. Max ratings: 75 hp, 220 v; 150 hp, 440-550 v.



A-B QUALITY

For years of dependable performance

ALLEN-BRADLEY DRUM SWITCHES

have no equal!

These Allen-Bradley drum switches provide simple and economical control for alternating current motors. Although low in cost, these unusually rugged switches are built under Allen-Bradley standards of *quality* . . . your assurance of reliable, trouble free performance. And this broad line of drum switches offers a variety of mounting types, operating handles, and interlocks to satisfy practically every requirement. Let us send you details on this versatile line of drum switches.

ALLEN-BRADLEY

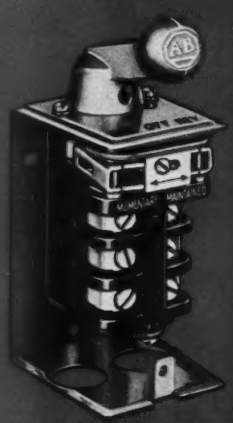
Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

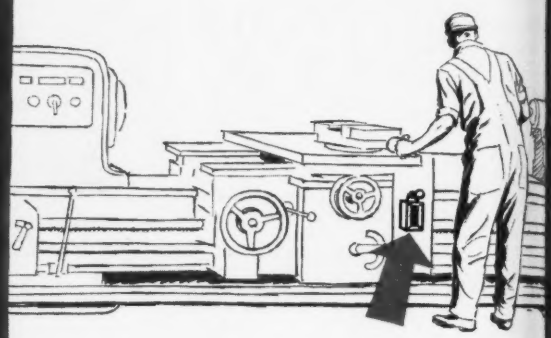
3-59-MR

ALLEN-BRADLEY

REVERSING DRUM SWITCHES



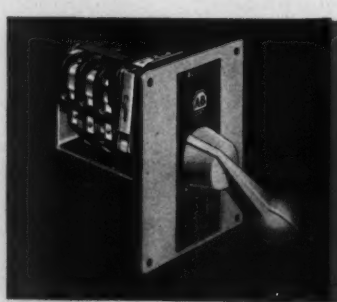
BULLETIN 350
Style A wrap-around cover is removed to show the readily accessible front wiring terminals. Max rating: 2 hp.



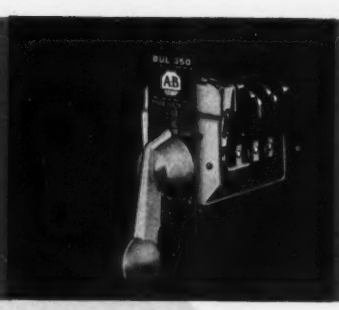
...styled to match the most modern production machines!

Inside and out—this Allen-Bradley drum switch is *all* new. Its trim, modern lines and attractive die-cast aluminum handle will give your production machines "up-to-the-minute" styling.

But there is more than beauty to this new switch. The rugged switch mechanism is a self-contained unit—independent of the enclosure. Misalignment and binding *cannot* occur. The base mounts directly on machine surfaces—without using spacers. And with the wrap-around cover removed, terminal screws are exposed for fast wiring—from the front. Changeover from momentary to maintained contact operation can be made in seconds. Investigate this new "leader" in its field. Send for Publication 6091.



OILTIGHT CAVITY MOUNTING
A-B Style AF reversing switches can be furnished with sealed shaft and rubber-gasketed, oiltight cover for cavity mounting in a machine base.



PANEL MOUNTING
The new Style A switches can be furnished for mounting directly on panels. Nameplate which gives ratings is also included with each switch.

ALLEN-BRADLEY

Quality Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

3-59-MR

Russians Claim New Heating Element

The Russians, who have claimed they invented everything from the bobby pin to the automobile, now report they have invented a revolutionary new heating element. It consists of a 3 to 4 millimeter thick panel, made of a mixture of rubber and acethylene-lamp black. The middle layer of the panel is a 220-v wiring net which spreads evenly over the panel's expanse, bedded on both sides in the rubber-lamp black compound. The surface of the panel is covered with electrodes in the form of a fine copper mesh.

The panels are mounted on the wall and serve as both a final wall covering and as a heating element. Four panels of one sq meter size each are claimed to heat a room of 20 sq meters floor size. The cost per panel so far is 20 Rubles or $5, but it is expected that quantity production will cut the cost 50%.

Consumption for a room of 20-sq meters floor area is 1 kw.

Heating Conference Held

The Electric Quartz Heating Industry Conference, devoted primarily to electric home heating, was held in Minneapolis, Minn., March 11. Discussions were on radiation, humidity, insulation, moisture barriers, controls, load, etc.

TESCO Display Attracts 145,000

This display which attracted some 145,000 people at an oil show in Odessa, Texas, is now being displayed at various Texas Electric Service Co offices. Other area show activities will also be covered.

The push button display was designed to stimulate the interest of both laymen and people in the oil industry at the show. The buttons for the multiple choice answers rang a buzzer when wrong. The correct answer buttons turned on a light which lighted the "right" sign.

Questions were:

- TESCO provides electric power to pump approximately 15,000-7,000-3,000 oil wells.
- TESCO has about 2,250-1,500-750 miles of distribution line presently serving the petroleum industry.
- The average usage per TESCO residential customer in this area is now 285 kwhr per month. This now costs, more than-less than-about the same as-it did it 1940.
- The average use of electricity for families in this area is, 3-4-8 times as much as in 1940.
- To enable you to Live Better Electrically there are now 19-43-62 electrical appliances for use in the home.

'Story of Light and Sight' Offered by BLBS

"The Story of Light and Sight," a new group of teaching aids for 4th, 5th and 6th grades, has been published by Better Light Better Sight Bureau.

They are designed to improve the pupil's understanding of the relationship of light and sight and to develop intelligent habits in the care of the eyes and the use of light for easy seeing.

The new materials were prepared by the Bureau's School Service Committee, chairmanned by R. J. Miller, Cleveland Electric Illuminating Co.

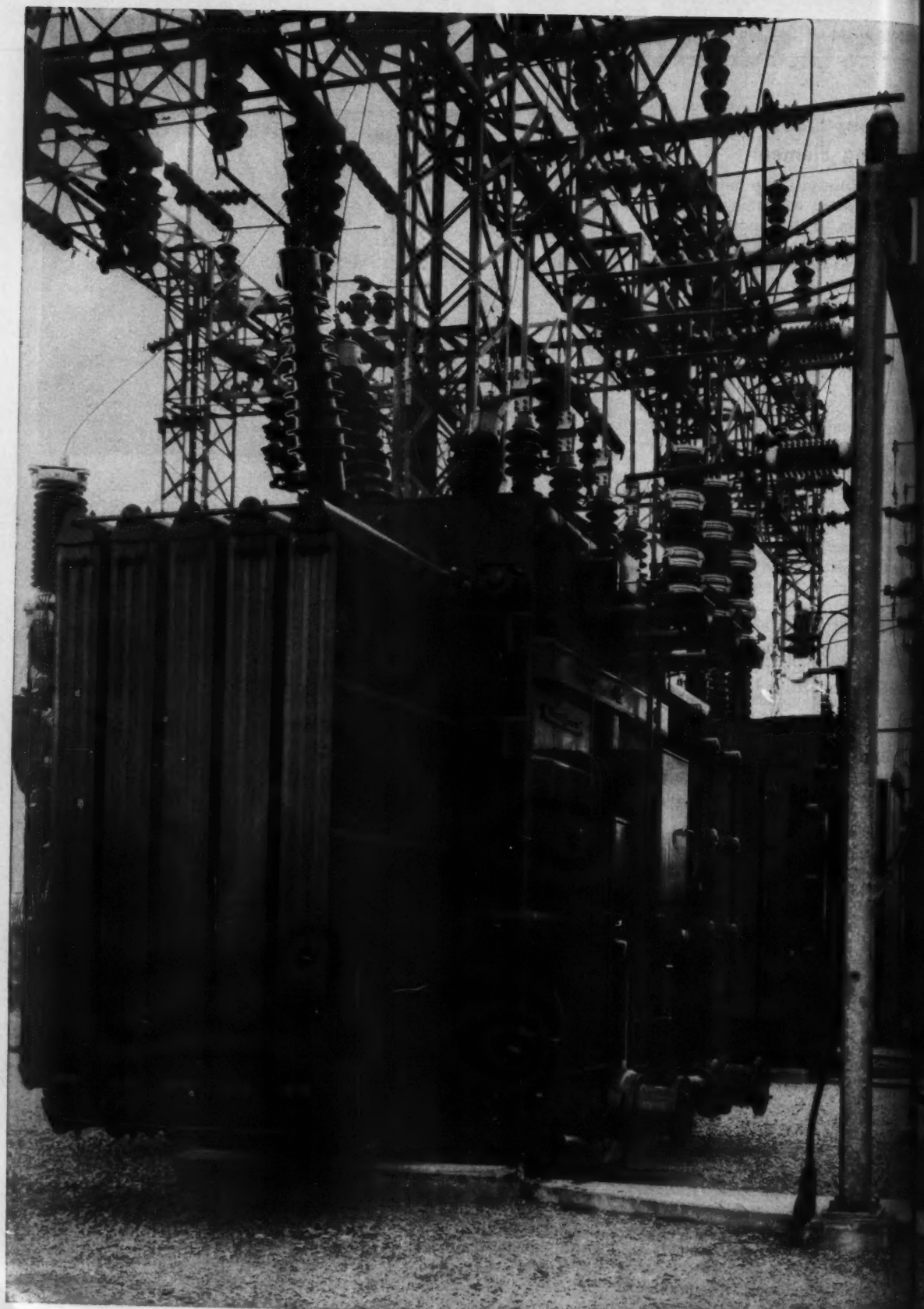
For details write: Better Light Better Sight Bureau, 750 Third Ave., New York 17, N. Y.

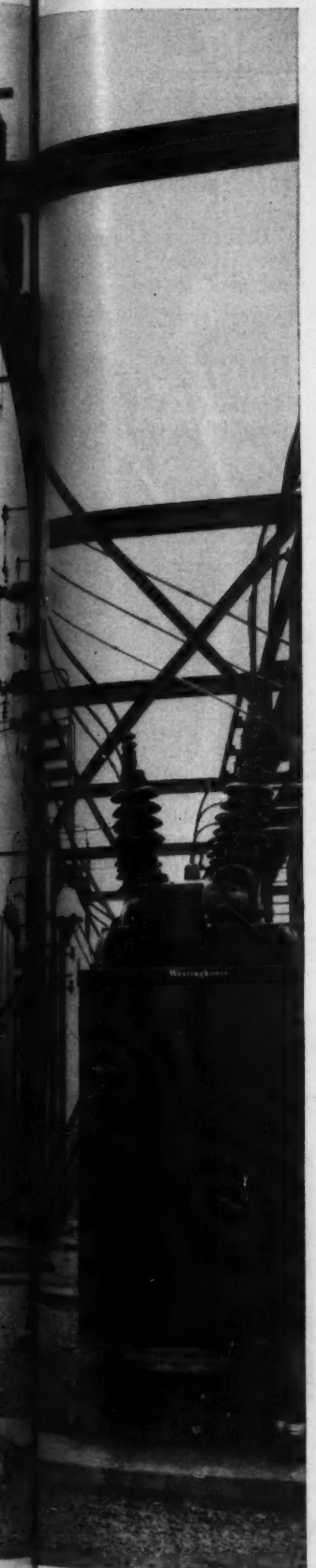
Dog Houses Are Now Heated Electrically

Even dogs are living better electrically, thanks to electrically heated dog houses.

In Savannah, Ga., the Savannah Electric & Power Co has displayed an electrically heated kennel which has a 65-deg temperature, maintained by automatic control. Price is $39.95, but fits average size dogs only.

Pomeranians are enjoying the comfort of electric heat in Loami, Ill. A dog breeder there has installed a radiant glass heat panel in the kennel to prevent newly born pups from chilling. Thermostatically controlled, the radiant heater keeps the inside temperature of the four-pen kennel at 70 deg when the puppies are born. Then it is gradually reduced to a minimum of 40.





Bonus Value Beyond the Specification...

HIGHEST KVA PER POUND

New Westinghouse Inner-Cooled Transformer Construction Also Cuts Installation Space and Cost

New York State Electric & Gas Corporation recently installed the world's first transformer with Inner-Cooled construction. Developed by Westinghouse, Inner Cooling makes possible drastic size and weight reductions; in this instance, weight per kva of the 30,000/40,000/50,000-kva transformer has been reduced from 3.5 to 3.1 pounds per kva; and on the higher voltage, higher kva units, the weight per kva has been reduced to as low as 1 pound per kva.

In addition to the installation savings made possible by major space and weight reductions, Inner Cooling also promises operating savings through lower impedances and improved performance. And by crashing the size barrier, Inner-Cooled construction makes it possible now to build and ship transformers with ratings up to 600,000 kva or more . . . to meet all demands of the foreseeable future.

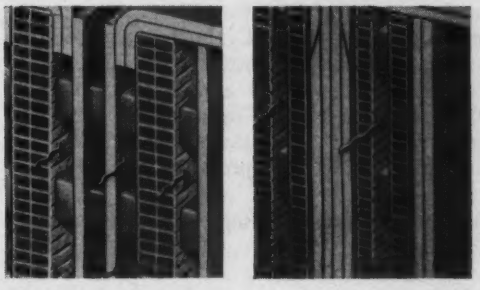
Ask your Westinghouse representative for the full story on the new Inner-Cooled construction—another "Bonus Beyond the Specification" made possible through Plowback of Earnings into transformer research and development.

J-70829

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

WORLD'S FIRST Inner-Cooled transformer (at left) is installed on the system of New York State Electric & Gas. Located at Hinman Road Substation, Lockport, New York, this Westinghouse power transformer is rated at 30,000/40,000/50,000-kva, OA/FOA/FOA. The Inner-Cooled transformer is installed in the same space as that of previously installed 15,000/20,000/25,000-kva transformer in the background.



Ordinary transformer construction (left) places the oil ducts on both sides of the coil consisting of multiple conductors wound in parallel. Inner Cooling (right) positions the oil ducts between the parallel-wound conductors, with cellulose material between adjacent coils. This utilizes fully both the dielectric and mechanical strengths of conventional transformer materials.

OTHER WESTINGHOUSE POWER TRANSFORMER BONUS VALUES

Insuldur* Insulation System—"Form-Fit" Construction—Vapor/gas Cooling—Reduced Sound Levels

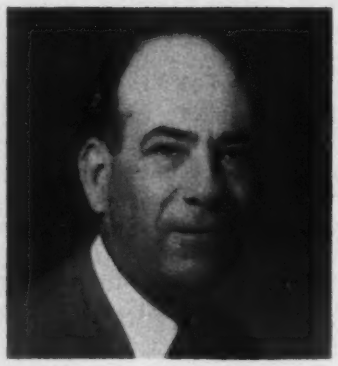
*Trade-Mark

News About People

Smith Elected VP at A-C

Allis-Chalmers Manufacturing Co has elected Beauchamp E. Smith, general manager of the Hydraulic Division, a vice president. He became general manager of the division in January, upon the merger of S. Morgan Smith Co and Allis-Chalmers. Prior to that he had been president of S. Morgan Smith for 17 years.

Smith joined the Georgia Power Co in 1924 as a draftsman and later served as a field engineer. He joined S. Morgan Smith at the end of 1925 as a junior engineer. He served as secretary from 1927 to 1937 and then was made vice president and general manager. He was named president and a director in 1942.



El Paso Electric Names Burgess VP

William D. Burgess has been named a vice president of El Paso Electric Co. He moves up from assistant to the president.

He joined the company in 1926, and remained with it until 1947 when he became vice president, general manager and director of Missouri Service Co. From 1949 to 1952 he was engineer and assistant sponsor for Stone & Webster Service Corp, and chief engineer for the Green Mountain Power Corp, from 1952 to 1954. He was executive assistant for Stone & Webster from 1954 to 1957 when he rejoined El Paso Electric.

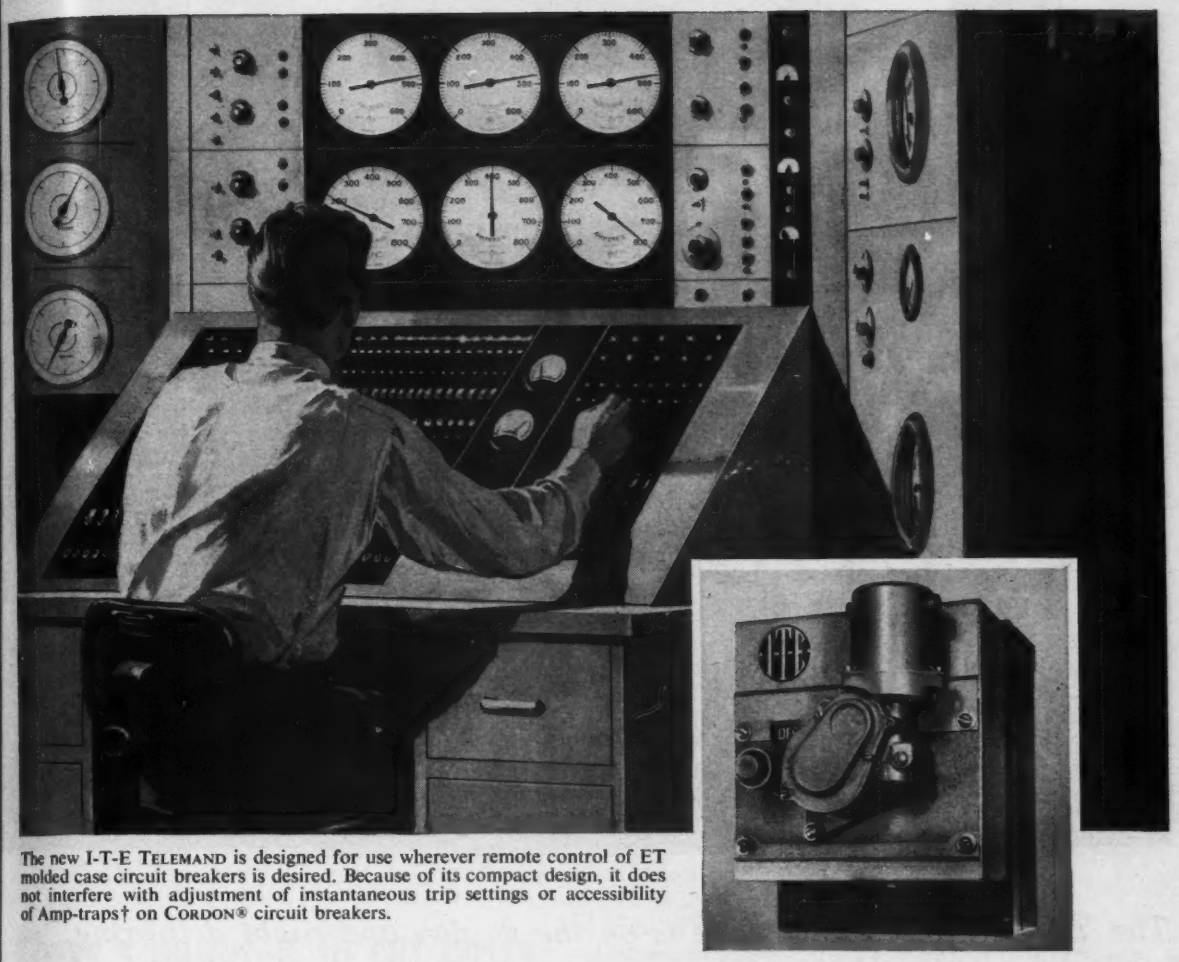
Harrison Elected President of Co-op Association

Walter Harrison, general manager of the Georgia Electric Membership Corp, Millen, Ga., has been named president of the National Rural Electric Cooperative Assn. R. A. Yarbrough, manager of Gate City Electric Co-op, Childress, Texas, was elected vice president, and Albert C. Hauffe, president, South Dakota Rural Electric Assn, has been elected secretary-treasurer.

Harrison, a resident of Millen, Ga., was elected a director of the Planters Electric Membership Corp in 1938 and its president in 1939, serving in the latter capacity for 11 years. He was vice president of the Georgia Electric Membership Corp from 1942 to 1944, president from 1944 to 1947, and has been manager since 1951.

He is a former member of the Georgia House of Representatives, and the state Senate.

HARRISON



The new I-T-E TELEMAND is designed for use wherever remote control of ET molded case circuit breakers is desired. Because of its compact design, it does not interfere with adjustment of instantaneous trip settings or accessibility of Amp-traps† on CORDON® circuit breakers.

NEW EXCLUSIVE DESIGN

I-T-E TELEMAND*

Remote Control of Molded Case Circuit Breakers

I-T-E Circuit Breaker Company now offers the electrical industry another exclusive—the new TELEMAND. This I-T-E designed device is the sturdiest, most foolproof, compact and economical unit ever built for electrically opening, closing or resetting molded case circuit breakers by remote control.

Designed to fit any I-T-E molded case breaker in ratings from 70 to 800 amperes, including the CORDON® line, this unit can be installed in a matter of minutes.

I-T-E's TELEMAND is industry's first really satisfactory answer to remote control of molded case circuit breakers. In remote control applications, the I-T-E TELEMAND ET Breaker combination may be used where bulkier, more expensive equipment would be required.

It is particularly appropriate for use in automatic transfer schemes and is ideal for use as a combination switch and protective device. Write today for full details. I-T-E Circuit Breaker Co., 1900 Hamilton St., Phila. 30, Pa.

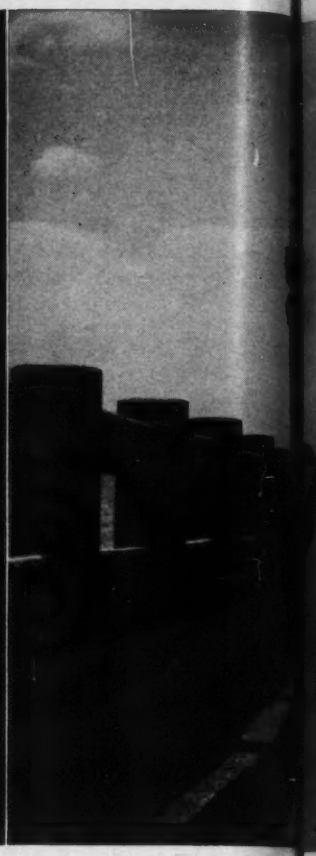
*Trademark, I-T-E Circuit Breaker Co.

†Amp-trap is a registered trademark of the Chase-Shawmut Company

I-T-E CIRCUIT BREAKER COMPANY

Chevy power is tough—

proves it with big savings on grueling delivery schedule!



The '59 Chevrolet shown here is on the go day and night delivering newspapers throughout west-central Florida. It covers as much as 587 miles a day . . . runs so constantly that its engine never cools off completely! Yet the truck, with newly improved Thriftmaster 6, is delivering 19.3 miles per gallon!

Here's on-the-job proof that Chevy's newly improved Thriftmaster 6 is set to chop your fuel costs to a new low—to save you dollars every day you go out on the job!

Delivering the Tampa Tribune & Times throughout west-central Florida, this truck hustles morning, noon and night to stay on schedule; keeps up a brisk pace over narrow, busy highways. It's forced to slow down and speed up continuously to meet traffic conditions and it runs so constantly that the engine never cools off entirely—yet it's averaging 19.3 miles per gallon!

Here in Florida, Chevy's 1959 Thriftmaster 6 with new Economy-Contoured Camshaft is showing its ability to keep expenses *down!*

Fighting the clock every mile, Chevy panel keeps on going—and saving—night and day.

No job's too tough for a

Chevy's powered to cut costs and keep going on your hurry-up hauls!

That's for *sure*, whether you use light-duty pickups, panels, stakes or chassis-cab trucks—whether you prefer 6's or V8's.

Take the 1959 Chevrolet Thriftmaster 6, for example, the engine that's building such a sensational economy record in the panel truck pictured above. Standard in all Series 30 and 40 models, it offers you proved stamina and saving ability that stems from a basic construction that's tops for tough truck power: efficient valve-in-head design, durability supplied by long-lasting Al-dipped exhaust valves, high-alloy steel inlet valves, forged steel crankshaft and rugged precision bearings.

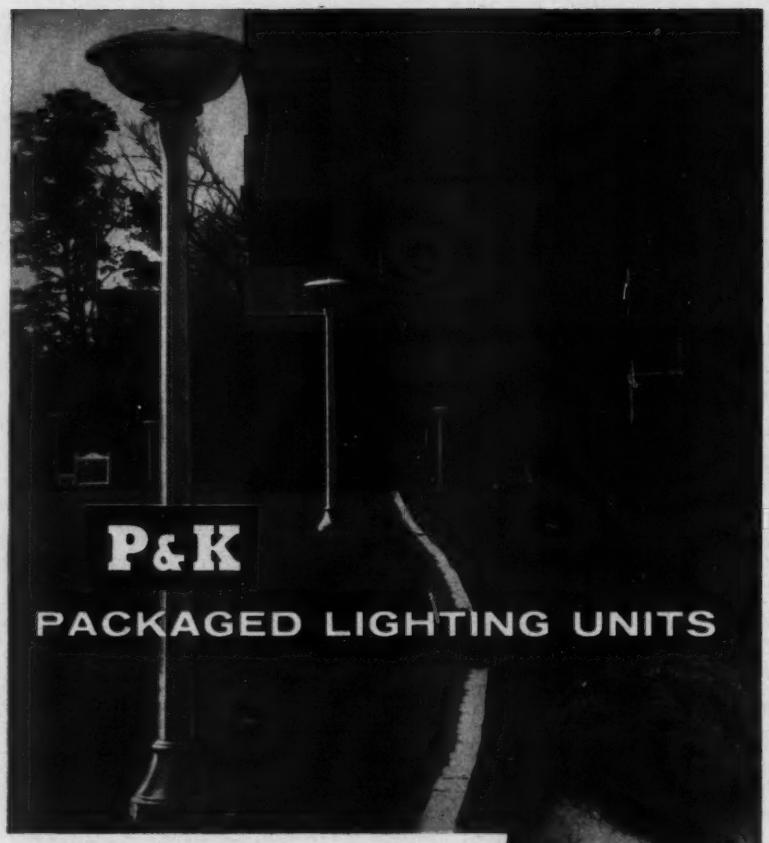
And this year the 135-h.p. Thriftmaster 6 provides new refinements that assure unprecedented economy. A new Economy-Contoured Camshaft, designed to provide less valve lift and overlap, improves gas economy by as much as 10% in normal operation—and by almost 25% when the engine is idling. And a new Maximum-Economy Option* cuts fuel consumption *an additional 10%* in Series 31 and 32 models.

Or if you're a V8 man, Chevy's *still* your best bet. Any light-duty conventional model you choose can be equipped with the big 160-h.p. 283-cubic-inch Trademaster V8*. It offers the *shortest piston stroke* of any V8 in its field, a sure sign of more work on less fuel. And it's loaded with up-to-the-minute features that know how to trim overhead: hydraulic valve lifters, oil bath air cleaner, full-flow oil filter, and dozens more.

V8 or 6, you'll go a long way before you see the likes of this '59 Chevy light-duty engine lineup. Actually, there's only one *best place* to go for all your trucking needs—and that's to your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Mich.

**Optional at extra cost.*

Chevrolet truck CHEVROLET



make the job easier!

"When Harrison Park wanted to provide lighting for the grounds of their new luxury apartments—they chose P & K packaged units. Thus, from one source, they were able to select pedestal and lighting units, with such a wide choice in each, that they effectively customized their installation with standard components."

For example, you can choose from a wide range of conventional designs—davit or straight—as well as many more advanced shapes for any particular lighting requirement for residential, commercial, industrial and street lighting applications. Whatever you choose, P & K's seamless, tapered all-aluminum construction assures high strength, ease of installation, and virtually no maintenance. In addition, you also select the light source best suited to your needs — incandescent, fluorescent or mercury vapor.

HARRISON PARK CHOSE

the P & K package unit consisting of a CIRCLElux incandescent post top unit, and a slim, tapered ten-foot aluminum pedestal to achieve both the lighting they wanted and the beauty their handsome building required. For more information, write for catalog L-2.

P&K

PFAFF & KENDALL

84 FOUNDRY ST., NEWARK 5, NEW JERSEY

Cruger Appointed Exec VP of Marcus

The Marcus Transformer Co has appointed Nicholas A. Cruger as executive vice president. He is also a director of the company. In his new post, he will serve in a general executive capacity, supervising all operational functions.

Before joining Marcus, Cruger was associated with Textron, Inc, Cluett-Peabody and Co, and Gruen Watch. He also had his own management consulting firm.

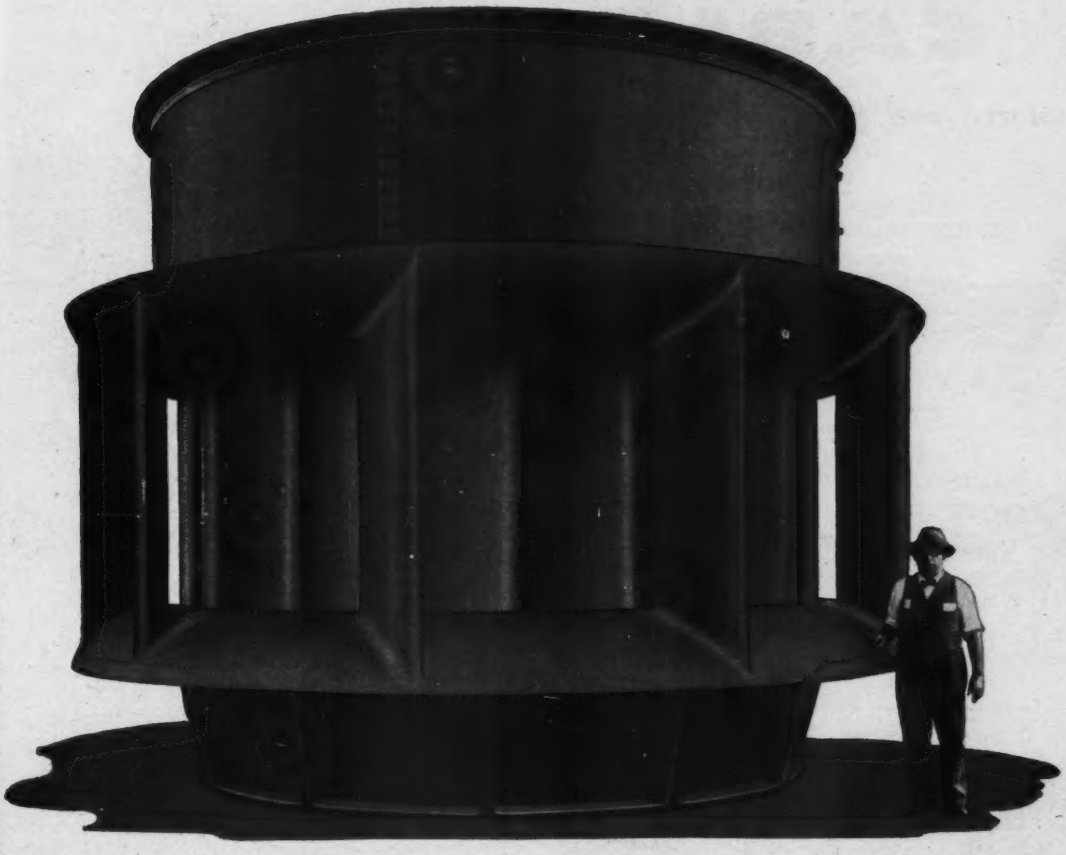
Bechtel Elects Bowman New Vice President

Robert A. Bowman has been elected vice president of Bechtel Corp. For the past six years, he was manager of engineering in the San Francisco headquarters of the Bechtel Power & Industrial Division.

He was with Westinghouse Electric Corp for 22 years and rose to

(*Continued on page* 96)

A LEFFEL TURBINE IS A TITAN OF QUALITY



The technical know-how, skilled personnel, use of the finest materials available, and rigid standards of quality control closely adhered to in the modern plant of The James Leffel & Company, enable Leffel to produce the ultimate in rugged, efficient turbines of the highest quality.

Leffel's experience is derived from almost a hundred years of designing and building turbines of all types. The records show that many Leffel turbines have developed efficient, low cost, trouble-free power for more than half a century.

Leffel produces all types and capacities of hydraulic turbines for a range of heads from 3 feet to over 1,000 feet. And Leffel engineers are available to assist you, at all times, from the original planning of your project through to the actual installation of the turbine equipment.

If you're planning a new project, or the rehabilitation or expansion of present facilities, contact Leffel for fast, complete service and rugged, top quality turbines.

Mail the coupon below for complete information about the abilities and services of Leffel.

THE JAMES LEFFEL & CO.

FOUNDED IN 1862

MORE EFFICIENT HYDRAULIC POWER FOR 97 YEARS

FREE LITERATURE

THE JAMES LEFFEL & COMPANY
DEPT. M, SPRINGFIELD, OHIO, U.S.A.

☐ Please send me more information on Leffel hydraulic turbines.

☐ Please have your representative call.

Name_____ Title_____

Company_____

Street_____ City_____ State_____

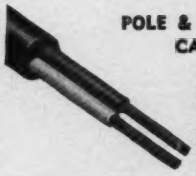
SUPERIOR POWER and CONTROL CABLES

Insulated and jacketed with modern plastics

600-1000V SD CONTROL CABLE

Flexible stranded conductors insulated with polyethylene. Nylon jacket over insulation provides extra protection. Mylar tape over cabled conductors, polyvinyl chloride outer jacket.

POLE & BRACKET CABLE



For use from street lamp base or overhead circuit to lighting fixture. Insulation is polyvinyl chloride, jacket is polyethylene. Operates at relatively low voltage between conductors, high voltage from conductors to ground.

600-1000V STATION CONTROL CABLE

Conductors insulated with polyethylene. S. I. C. rating (2.3%) and Power Factor rating (.0003) remains constant at high frequency. Mylar tape over cabled conductors, polyvinyl chloride jacket overall.

FIGURE 8 POLE & BRACKET CABLE

For 0-600V service. Insulated with polyvinyl chloride. Does not deteriorate with age or weather, resists abrasion and mechanical damage, is not affected by common chemicals nor electrolysis. Will not support combustion.

SUPERVISORY CONTROL CABLE

Conductors polyethylene or polyvinyl chloride insulated. Polyethylene or polyvinyl chloride jacket. With or without shielding. Color-coded to IPCEA specifications or as desired. Composite types with twisted pairs available.

CATHODIC PROTECTION CABLE

Polyethylene insulation with polyvinyl chloride jacket or special polyethylene jacket. Highly resistant to most acids, alkalies and chemicals usually found in corrosive soil areas.

STREET LIGHTING CABLE

Thermoplastic series lighting cables for direct burial, in ducts or overhead. Highly resistant to earth acids and alkalies, moisture, sunlight and weather. With either polyethylene or polyvinyl chloride insulation and either polyethylene or polyvinyl chloride jacket. Shielded types available.

BUS DROP CABLE

Designed especially to provide flexible branch circuit runs between overhead bus feeders to shop and plant equipment. Conductors are color-coded. Insulation and jacket are polyvinyl chloride.

SUPERIOR CABLES are manufactured under a rigid quality control system and are thoroughly tested prior to delivery to assure satisfactory performance.

For complete information and prices, write

SUPERIOR CABLES

SUPERIOR CABLE CORPORATION

Hickory, North Carolina

3465

Bowman New VP

(*Continued from page* 94)

manager of engineering, Atomic Power Division. In that capacity, he was responsible for engineering in connection with the design of the propulsion plant for the atomic submarine, Nautilus.

Leary Elected VP of Cornell-Dubilier

Raymond T. Leary, sales manager of the Distributor Division of Cornell-Dubilier Electric Corp, has been elected a vice president.

Leary has been with Cornell-Dubilier since 1946, first in the Chicago office and most recently at the main office at South Plainfield, N. J.

PERSONAL BRIEFS

A. R. Watson, executive vice president and general manager of Southwestern Public Service Co has been elected to the company's board of directors, and **J. T. Bradley** has been named treasurer and assistant secretary.

Saskatchewan Power Corp has made **C. E. Smith** director of public and employee relations; **E. J. Durnin,** director of planning and administrative controls; and **J. C. Blewett,** executive assistant to the general manager.

Donald G. Lewis, vice president of American & Foreign Power Co, has been named administrative assist-

IBM® COMPUTERS GIVE TIGHTER CONTROL OF TRANSFORMER LOADS

Today, the tighter control of distribution transformer loadings—made possible by IBM digital computers—is resulting in fewer outages, improved consumer voltage, reduced transformer losses, and scheduled changes.

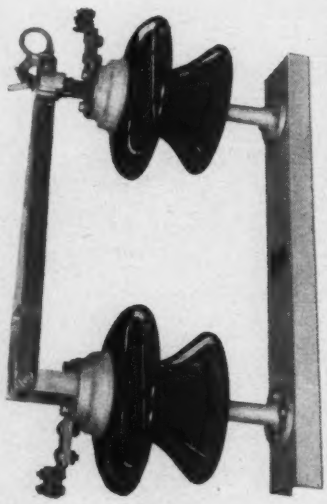
With this system, customer kw-hr consumption recorded on IBM punched cards gives an up-to-date picture of every consumer's usage. This data is then translated by the computer to the corresponding kva demand figures for each consumer class. The computer now sums the kva demand on each transformer and where this is excessive it signals the overloaded transformer and its location. This enables engineers to make transformer changes on a scheduled basis, at minimum expense and during regular working hours.

IBM digital equipment offers the distribution engineer many advantages: radial fault calculations; determination of most economical conductor sizes; volt drop and loss computations; capacitor placement studies; table look-up operations; fast logical decisions.

Not confined to special purposes, IBM equipment can be used by both engineering and accounting departments for solving the problems of utility systems.

Call your local IBM representative today for more detailed information on IBM digital computers—engineering time-savers you shouldn't overlook.

OUTDOOR DISCONNECT SWITCHES



TYPE BT

TOP SERVICE RECORDS FOR MORE THAN 25 YEARS

The rugged simplicity of these Royal switches affords *big* features with substantial cost savings.

Contacts are tongue type with latch tips flared to provide a 4" wide blade guide. The guide fingers overlap the blade in closed position to insure a positive latch.

Truss type construction blades of hard drawn switch copper provide long service life. All contact surfaces are silver plated.

Manufactured in 400 thru 4000 ampere capacities and in ratings from 7.5 thru 161 kv. All Royal Switches meet established NEMA Standards.

FOR FULL DETAILS WRITE TO:

ROYAL

ROYAL ELECTRIC MANUFACTURING CO., INC.
1122 EAST 87TH STREET • CHICAGO 19, ILLINOIS
Designers and Manufacturers of
Power Switching Equipment and Special Electrical Devices

ant to Myron G. Reed, executive vice president in charge of operations. **R. A. Lucey, W. J. Rolfs,** and **J. G. True,** formerly vice presidents and directors of Ebasco International, were appointed to Reed's staff as regional representatives for the eleven Latin American countries served by A&FP.

Holmes D. Harper has been promoted to district engineer at Winchester for the Potomac Edison Co. **Donald K. Clark** has been appointed representative for the Hancock-Berkeley Springs area.

John E. Miles, former governor and congressman, and **Albert Schubert,** former fieldman for the state bureau of revenue, have been appointed to the New Mexico Public Service Commission.

Basil Nikiforoff, technical director of the Mexican Light & Power Co, has retired after 34 years of service.

Cyril R. Broadhead has retired as power sales manager of Narragansett Electric Co. He has been succeeded by **Frank E. Caulfield.**

L. W. Haley has been promoted to Blue Grass division manager of Kentucky Utilities Co.

A. T. Wilks has retired as assistant to the Huntington Division, Appalachian Power Co.

P. T. Heady has been named superintendent at the Miami Fort Station of Cincinnati Gas & Electric Co. He succeeds **J. H. Heimbrock** who has retired.

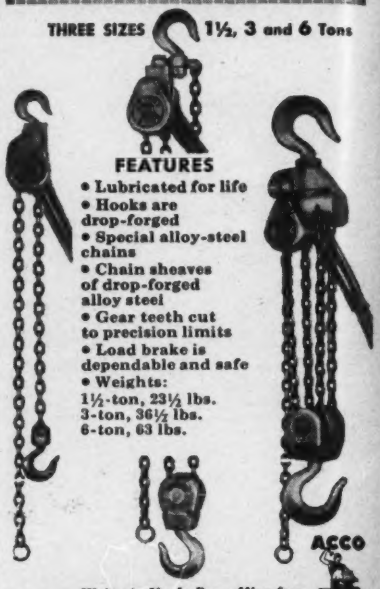
Whether a Winch Line Hook or a complete Line Body check your requirements with

UTILITY TOOL & BODY CO.
CLINTONVILLE, WISCONSIN

BUILDERS OF DEPENDABLE EQUIPMENT SINCE 1895 UT&BCo.

NEW WRIGHT Type "C" Pull-A-Ways

THREE SIZES 1½, 3 and 6 Tons



FEATURES
- Lubricated for life
- Hooks are drop-forged
- Special alloy-steel chains
- Chain sheaves of drop-forged alloy steel
- Gear teeth cut to precision limits
- Load brake is dependable and safe
- Weights:
  1½-ton, 23½ lbs.
  3-ton, 36½ lbs.
  6-ton, 63 lbs.

ACCO

Write to York, Pa., office for complete information

Wright Hoist Division
AMERICAN CHAIN & CABLE
York, Pa., Bridgeport, Conn.

ELECTRICAL ENGINEERS

TEST ENGINEERS

Recent grad acceptable. Draft exempt. For new high voltage research lab near Chicago.

APPARATUS ENGINEERS

Experience in sales and/or design of electrical apparatus. Openings in New York, Chicago, Cincinnati and Atlanta sales territories. Car furnished. Will assist sales personnel in technical sales applications.

DESIGN ENGINEERS

Five years or more experience in design of high voltage apparatus, preferably switchgear. Should be able to follow design assignment through to successful conclusion including the guidance of detail design, research and testing. Melrose Park, Illinois, location.

These outstanding positions available because of company expansion. Excellent starting salary and employee benefit programs (profit sharing, group insurance, tuition refund). E.E. degrees required. Write, wire, phone or come in.

W. L. DAVIDSON
Personnel Director

HUBBARD AND COMPANY
200 S. Michigan Avenue
Chicago 4, Illinois
Phone WAbash 2-2135

the work's lighter

when the light's brighter!

WESTINGHOUSE SUPER-HI™ FLUORESCENT LAMPS ARE 2½ TIMES BRIGHTER!

Rosie's just collected an armful of posies from the boss. Since they put in Westinghouse Super-Hi fluorescent lamps, everything's looked brighter (2½ times brighter than with regular fluorescents, in fact) and Rosie's efficiency has soared.

Of course what Rosie didn't know is that:

- "Ultralume"™ phosphors maintain maximum light levels for the life of the lamp.
- Special cooling chambers give *longer life*, as well as more light.
- New leads are chromium-vanadium plated to eliminate end-darkening.
- Smooth, slim design gives uninterrupted brightness all around the tube . . . much lighter weight for safer, easier handling.
- They're interchangeable . . . can be used in any fixtures designed for new high intensity lamps.

This all made the boss very happy, too. He found not only were morale and efficiency higher, but that he could save money while getting more light from the same number of fixtures.

Why not get the details for yourself? Just call your local Westinghouse agent, or write—Westinghouse Lamp Division, Dept. 57-L-5, Bloomfield, New Jersey.

YOU CAN BE SURE...IF IT'S **Westinghouse**

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

Advance Buying Argued at PA Meeting

(*Continued from page* 37)

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–PROFESSIONAL SERVICES–

BLACK & VEATCH
Consulting Engineers
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Investigations, Valuations and Rates
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Transmission Lines
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Determination
Ann Arbor, Michigan

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ENGINEERING CO.
Consulting and Design
Engineers . . . Purchasing
Specialists in Financing
Accounting and other Operations
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Nation Wide Mapping Services
• Utility Area Base Maps
• Symbolized System Portrayal
Atlanta - New York - Chicago - San Francisco

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140 South Dearborn St.
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Mechanical • Electrical • Thermodynamic
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Power Stations • Transmission • Distribution
Industrial Plants • Process
1333 North Second Street Abilene, Texas

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

DISPLAYED RATE: ——RATES—— **UNDISPLAYED RATE:**

EMPLOYMENT OPPORTUNITIES: $22.87 per inch. Subject to Agency Commission.
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PROPOSALS, $1.80 a line an insertion.
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DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

POSITION WANTED

Meter and Relay Specialist with administrative and organizational training and experience desires a challenging opportunity. Specialized training and experience in a first rate electric utility, in the testing and servicing of all types of metering and modern relay equipment, high voltage circuit breakers and central station apparatus. Best quality reference furnished. PW-9404, Electrical World.

FOR LEASE

11,000 Sq. ft.—Modern Industrial Building for sale, or lease. In N. J. 40 miles from New York Alongside R.R. Acreage available. Would consider combination lease-partnership good proposition. FR-1211, Electrical World.

FOR ADDITIONAL INFORMATION
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R. POWELL

BOSTON, 16
350 Park Square *HUbbard 2-7160*
D. J. CASSIDY

CHICAGO, 11
520 No. Michigan Ave. *MOhawk 4-5800*
W. HIGGENS D. C. JACKMAN

CLEVELAND, 13
1164 Illuminating Bldg. *SUperior 1-7000*
W. B. SULLIVAN P. M. BUTTS

DALLAS, 2
1712 Commerce St., Vaughn Bldg. *Riverside 7-5117*
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DETROIT, 26
856 Penobscot Bldg. *WOodward 2-1793*
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LOS ANGELES, 17
1125 W. 6 St. *HUntley 2-5450*
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NEW YORK, 36
500 Fifth Ave. *OXford 5-5959*
H. T. BUCHANAN R. P. LAWLESS

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ST. LOUIS, 8
3615 Olive St. *JEfferson 5-4867*

SAN FRANCISCO, 4
68 Post St. *DOuglas 2-4600*
R. ALCORN

FOR SALE

4—1000 K.V.A. single phase Moloney transformers. Voltage—4160 to 7200/12470. Taps—Standard, above and below. Like New Condition, used 8 years. Also complete steel substation, will sell as a unit or separately. Contact LOUIS E. NELSON, Supt. of Public Utilities, Litchfield, Minnesota.

USED TRANSFORMER WANTED

1. 69,000 volts—single phase transformer.
2. 7500-10,000 kva
3. Secondary Voltage: 12,000 or 13,800 or 7200

W-1276, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

WANTED
OUT-DOOR SUB-STATION

500-750 KVA, 3 phase, oil or askarel type, 13.8 KV primary to 277/480 volt secondary, complete with HV and LV switchgear.

Reply to: D. J. JOHNSON
P.O. Box 225 East Islip, L. I., N. Y.

OPPORTUNITY FOR REPRESENTATIVES
Established Manufacturer of Transformers—10,000 KVA, 115 KV and below—Oil, Askarel and Dry Types—interested in contacting aggressive manufacturers' representatives for representation in the following territories:
New England States, Indiana, Kentucky, Iowa, Kansas, Missouri, Oklahoma, Western Tennessee & Arkansas, State of Washington, Colorado
RW-1078, Electrical World
Class. Adv. Div., P.O. Box 12, N. Y. 36, N. Y.

ADDRESS BOX NO. REPLIES TO: Box No.
Classified Adv. Div. of this publication.
Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Wanted—Superintendent, qualified to supervise operation of diesel generation and the distribution system of municipal electric system, also some duties as City Engineer. Give experience, education, marital status, salary expected in first letter to Sam Southerland, City Clerk, Wauchula, Florida.

Wanted—major British cable manufacturer seeking sales engineer with experience selling electrical transmission cable for overseas use to engineering firms, government agencies, contractors and utilities doing work abroad. Eng. degree not required. Salary commensurate qualifications. Contact Ampower Corporation, 50 Broad Street, New York 4—WHitehall 4-6975.

Plant Superintendent-Plant Engineer: For operation of offshore power plant, three 125,000 lbs. per hour boilers, 34,500 kilowatts generating plant. One year contract, isolated location, families not permitted. Rate for Superintendent $1350.00 per month, Engineer $1250.00 per month. Subsistence furnished. Give experience and availability date in first letter. P-1278, Electrical World.

SELLING OPPORTUNITIES OFFERED

Representative wanted for manufacturer of street lighting equipment, pole line specialties. Full particulars. RW-9821, Electrical World.

Manufacturer of substation equipment interested in securing live wire representative in the state of Ohio. RW-1098, Electrical World.

Readers Forum

Welcome All, To "Electrical Dreamers Club"

To the Editor:

Was very interested in your column about the "Crack Pot Division" and the "Electrical Dreamers Club" (EW, Feb. 23, p5).

Here's one that you might throw open to the boys.

Many, many years ago my father had an electric chafing dish made by Chase Brass.

When the dish became unserviceable we tried to get it repaired and many inquiries have found that it cannot be repaired nor have we found one available on the market.

In short, with the outdoor cooking and what have you, all chafing dishes seem to be the alcohol or canned heat type.

Is it possible that with all the electrical commotion and merchandise there is no longer an electric chafing dish available?

If there is still one available, who makes it? Where can it be purchased?

Richard Hoe Osgood
Osgood & Associates, Inc.
Atlanta 9, Ga.

To the Editor:

Keep the Aspidistra Flying

(With apologies to Orwell)

Four highly intelligent dreamers did dream
Dreamed of electric auto cars and 12 volt teddy b'ars
And electric lights strung to the moon in a stream

Now they give to positive dreams a place
Between-the-ads of the journal for exposition eternal
But to doubters they assign only the Crackpots' space

These are no days when the dull deviant detracts
To upset the optimists dreams and confuse the rosy schemes
Of the highly intelligent dreamers, with the facts.

But these are days when statistics and stochastics
Keep the aspidistra flying and the customers buying
And the future will belong to the mental gymnastics.

Harold L. Sangster

Route 1, Box 63
Boyds, Maryland

Editors' Note: "Aspidistra" is a small, hardy flowering plant used by Author George Orwell to symbolize the steady determination of the British middle class.

To the Editor:

Subject: Electrical home heating.

Need: A battery of highbrows to study a new method of home heating.

New Method: The use of the same material that is now being used to coat the lining of the jet planes that creates its own heat from friction.

Why bring up this idea: Could we not make electricity do the same job as friction now does to create heat and thereby bring about a cheaper method of heating homes?

Put me on your list for the "Dreamers Club".

Dwight Khun
Columbus and Southern Ohio Electric Co
Chillicothe, Ohio

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CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 101

EQUIPMENT (Used or Surplus New) For Sale 101

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

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Erection and Maintenance of Electrical Transmission and Distribution Lines
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Engineers
Appraisals—Investigations—Depreciation Studies—Cost Trends—Reports
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Original Cost and Continuing Property Record Determination
Ann Arbor, Michigan

PIONEER SERVICE & ENGINEERING CO.
Consulting and Design Engineers . . Purchasing Specialists in Financing Accounting and other Operations
231 So. La Salle St. Chicago 4

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Nation Wide Mapping Services
• Utility Area Base Maps
• Symbolized System Portrayal
Atlanta - New York - Chicago - San Francisco

SARGENT & LUNDY
Engineers
140 South Dearborn St.
Chicago, Ill.

TIPPETT & GEE
Consulting Engineers
Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process
1333 North Second Street Abilene, Texas

SEARCHLIGHT SECTION

(Classified Advertising)

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1301 Rhodes Haverty Bldg. *JAckson 3-6951*
R. POWELL

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350 Park Square *HUbbard 2-7160*
D. J. CASSIDY

CHICAGO, 11
520 No. Michigan Ave. *MOhawk 4-5800*
W. HIGGENS D. C. JACKMAN

CLEVELAND, 13
1164 Illuminating Bldg. *SUperior 1-7000*
W. B. SULLIVAN P. M. BUTTS

DALLAS, 2
1712 Commerce St., Vaughn Bldg. *Riverside 7-5117*
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LOS ANGELES, 17
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T. H. HUNTER

NEW YORK, 36
500 Fifth Ave. *OXford 5-5959*
H. T. BUCHANAN R. P. LAWLESS

PHILADELPHIA, 3
Six Penn Center Plaza *LOcust 8-4330*
H. W. BOZARTH T. W. McCLURE

ST. LOUIS, 8
3615 Olive St. *JEfferson 5-4867*

SAN FRANCISCO, 4
68 Post St. *DOuglas 2-4600*
R. ALCORN

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USED TRANSFORMER WANTED

1. 69,000 volts—single phase transformer.
2. 7500-10,000 kva
3. Secondary Voltage: 12,000 or 13,800 or 7200

W-1276, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

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OUT-DOOR SUB-STATION

500-750 KVA, 3 phase, oil or askarel type, 13.8 KV primary to 277/480 volt secondary, complete with HV and LV switchgear.

Reply to: D. J. JOHNSON
P.O. Box 225 East Islip, L. I., N. Y.

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Established Manufacturer of Transformers—10,000 KVA, 115 KV and below—Oil, Askarel and Dry Types—interested in contacting aggressive manufacturers' representatives for representation in the following territories:
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RW-1076, Electrical World
Class. Adv. Div., P.O. Box 12, N. Y. 36, N. Y.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
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CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Wanted—Superintendent, qualified to supervise operation of diesel generation and the distribution system of municipal electric system, also some duties as City Engineer. Give experience, education, marital status, salary expected in first letter to Sam Southerland, City Clerk, Wauchula, Florida.

Wanted—major British cable manufacturer seeking sales engineer with experience selling electrical transmission cable for overseas use to engineering firms, government agencies, contractors and utilities doing work abroad. Eng. degree not required. Salary commensurate qualifications. Contact Ampower Corporation, 50 Broad Street, New York 4—WHitehall 4-6975.

Plant Superintendent-Plant Engineer: For operation of offshore power plant, three 125,000 lbs. per hour boilers, 34,500 kilowatts generating plant. One year contract, isolated location, families not permitted. Rate for Superintendent $1350.00 per month, Engineer $1250.00 per month. Subsistence furnished. Give experience and availability date in first letter. P-1278, Electrical World.

SELLING OPPORTUNITIES OFFERED

Representative wanted for manufacturer of street lighting equipment, pole line specialties. Full particulars. RW-9821, Electrical World.

Manufacturer of substation equipment interested in securing live wire representative in the state of Ohio. RW-1098, Electrical World.

Readers Forum

Welcome All, To "Electrical Dreamers Club"

To the Editor:

Was very interested in your column about the "Crack Pot Division" and the "Electrical Dreamers Club" (EW, Feb. 23, p5).

Here's one that you might throw open to the boys.

Many, many years ago my father had an electric chafing dish made by Chase Brass.

When the dish became unserviceable we tried to get it repaired and many inquiries have found that it cannot be repaired nor have we found one available on the market.

In short, with the outdoor cooking and what have you, all chafing dishes seem to be the alcohol or canned heat type.

Is it possible that with all the electrical commotion and merchandise there is no longer an electric chafing dish available?

If there is still one available, who makes it? Where can it be purchased?

Richard Hoe Osgood
Osgood & Associates, Inc.
Atlanta 9, Ga.

To the Editor:

Keep the Aspidistra Flying

(With apologies to Orwell)

Four highly intelligent dreamers did dream
Dreamed of electric auto cars and 12 volt teddy b'ars
And electric lights strung to the moon in a stream

Now they give to positive dreams a place
Between-the-ads of the journal for exposition eternal
But to doubters they assign only the Crackpots' space

These are no days when the dull deviant detracts
To upset the optimists dreams and confuse the rosy schemes
Of the highly intelligent dreamers, with the facts.

But these are days when statistics and stochastics
Keep the aspidistra flying and the customers buying
And the future will belong to the mental gymnastics.

Harold L. Sangster

Route 1, Box 63
Boyds, Maryland

Editors' Note: "Aspidistra" is a small, hardy flowering plant used by Author George Orwell to symbolize the steady determination of the British middle class.

To the Editor:

Subject: Electrical home heating.

Need: A battery of highbrows to study a new method of home heating.

New Method: The use of the same material that is now being used to coat the lining of the jet planes that creates its own heat from friction.

Why bring up this idea: Could we not make electricity do the same job as friction now does to create heat and thereby bring about a cheaper method of heating homes?

Put me on your list for the "Dreamers Club".

Dwight Khun
Columbus and Southern Ohio
Electric Co
Chillicothe, Ohio

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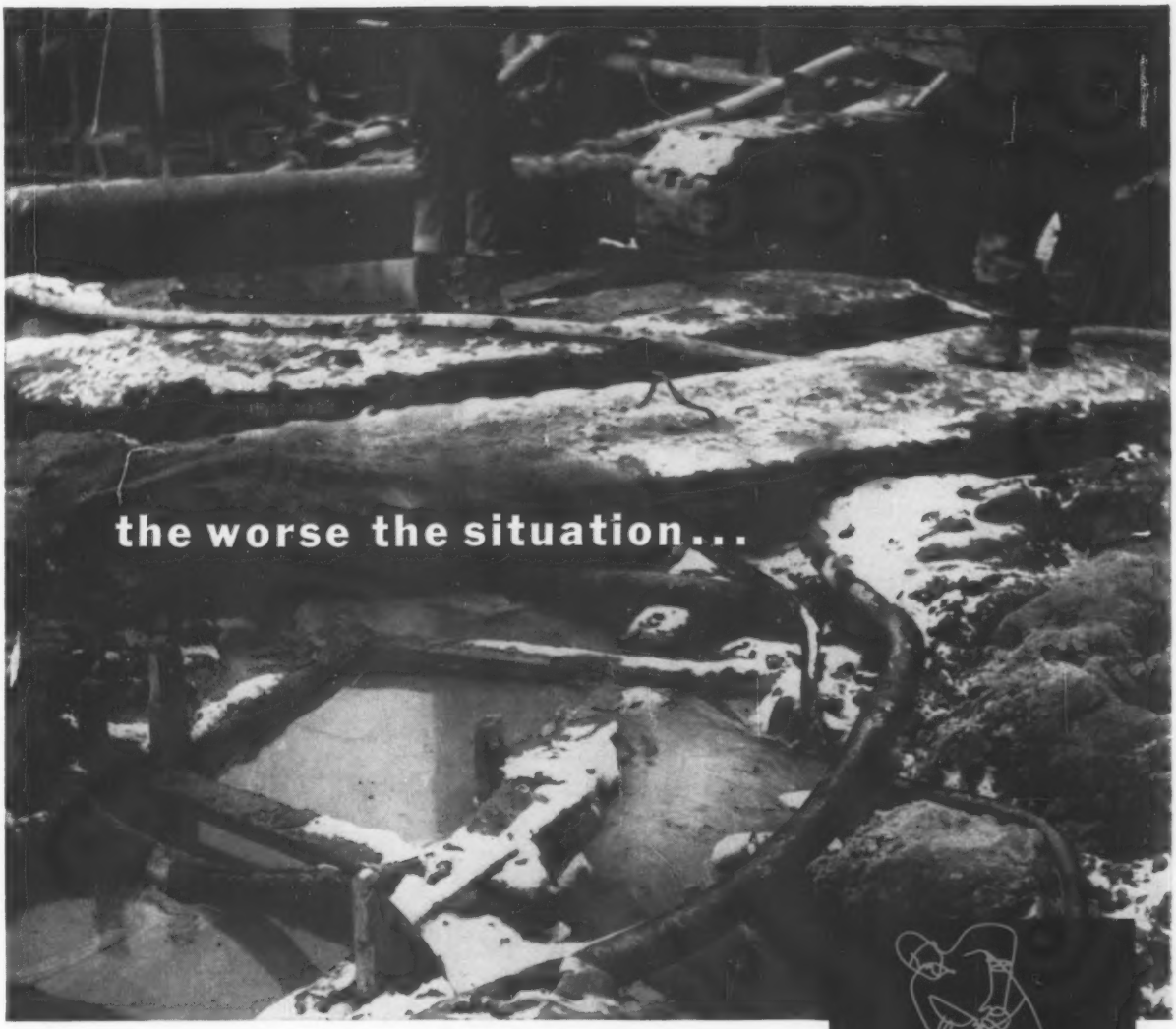

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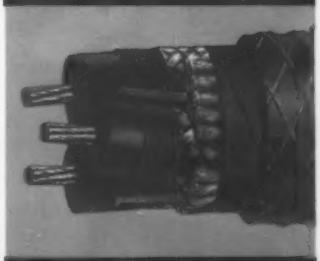

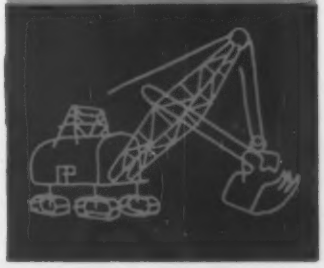

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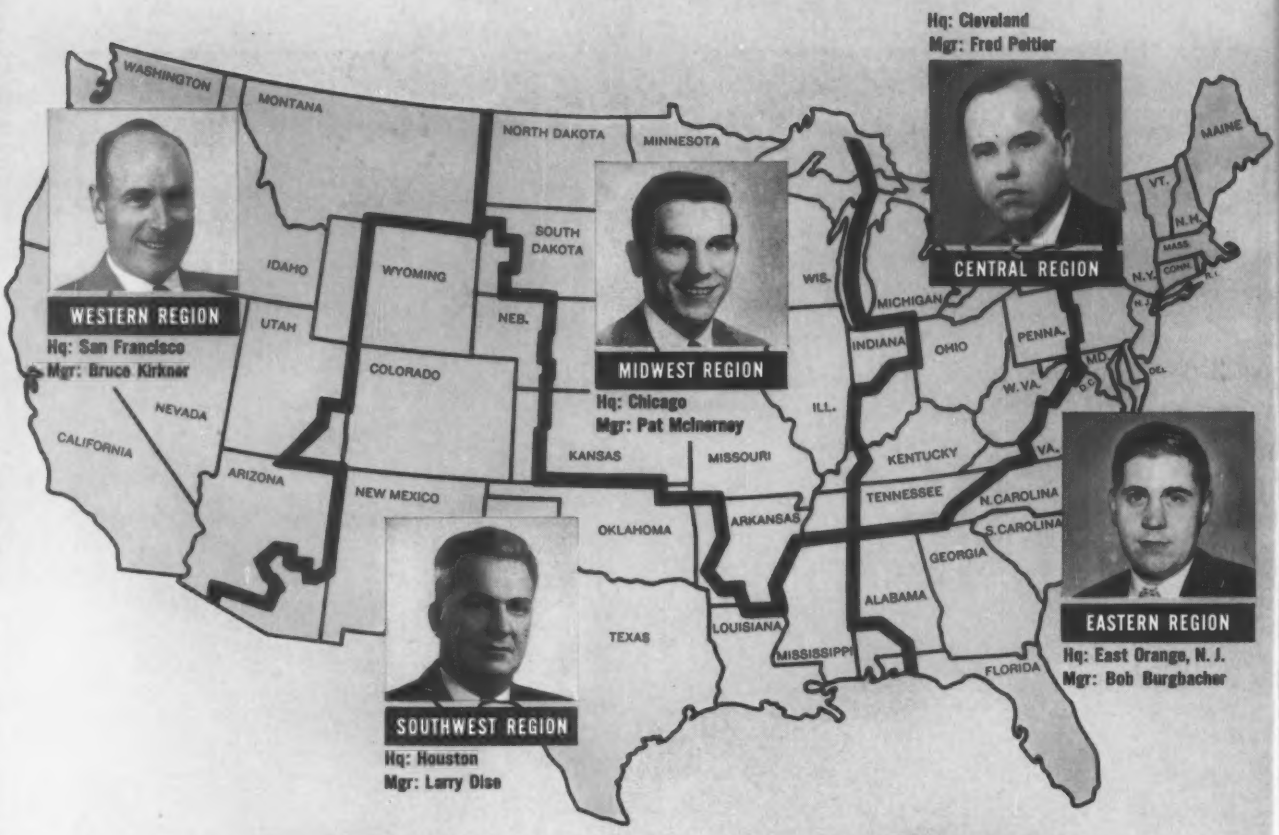

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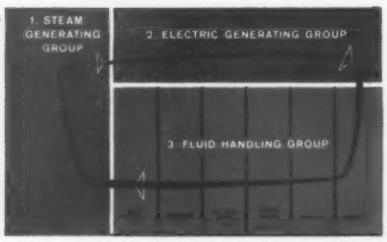

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